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Technical Report 693

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Development of a Computer Simulation for Assessing Decision-Making Style Using Cognitive Complexity Theory

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This report documents the design and development of a Managerial Assessment and Training Simulation System (MATSS). The MATSS is a computer-based simulation of a hypothetical military/political crisis in Yugoslavia in 1988. Participants act in the simulation to cope with the dilemma as the computer collects real-time data on their decision-making strategy. Measures of performance are based on interactive complexity theory, which is concerned with the structure rather than the content of decision making.

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FOREWORD

One of the goals of the Leadership and Management Technical Area of the Army Research Institute for the Behavioral and Social Sciences is to provide the Army with tools and procedures for improved management and leadership. This report describes the development of a prototype computer-based simulation for the assessment of the complex decision-making skills required of senior Army leaders. The simulation is based on the interactive complexity theory of decision-making styles and is applied to a macro-level international crisis scenario. It is likely to be of interest to researchers and others concerned with the assessment and development of complex decision-making skills of senior Army leaders.

EDGAR M. JOHNSON
Technical Director

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DEVELOPMENT OF A COMPUTER SIMULATION FOR ASSESSING DECISION-MAKING STYLE USING COGNITIVE COMPLEXITY THEORY

EXECUTIVE SUMMARY

Requirement:

The design, development, and documentation of a Managerial Assessment and Training Simulation System (MATSS), based on a psychological theory known as interactive complexity theory, have been the major goals of a large, 3-1/2-year project. The MATSS is a computer-based simulation of a hypothetical complex crisis situation. The simulation assesses participant decision making in the crisis. This report is the final project report.

Procedures:

Topics in this report include project overview and simulation development, interractive complexity theory and measurement, a description of the MATSS, and recommendations for future uses of the MATSS. All of the numerous project documents that precede this report are referenced.

Findings:

The emphasis of the MATSS development project has been managerial decision making. The MATSS simulation design derived from interactive complexity theory, which concerns the structure of decision making. The MATSS simulation is presented on an Apple II microcomputer. The system collects real-time data on participants' action and produces 14 measures of their decision-making styles. System software is fully functional, correctly collects and analyzes participant data, and is adaptable to content areas other than the hypothetical political-military scenario termed the "Yugoslav Dilemma," which is used in the MATSS. In addition, the project has produced numerous reports and technical memoranda that fully document the project. Among the documents are three important manuals to accompany the Yugoslav Dilemma: participant, researcher, and programmer manuals.

Use of Findings:

These findings will be of interest to future users of the MATSS and to those who wish to construct similar simulations. The MATSS will be of special interest to those studying decision making in management. In addition, the findings will be of interest to those interested in interactive complexity theory.

INTRODUCTORY STATEMENT

This document is one in a series of reports on research conducted by the Behavioral Sciences Research Center at Science Applications, Inc., under Contract No. MDA 903-79-C-0699 with the U.S. Army Research Institute for the Behavioral and Social Sciences. The work on this contract has involved designing and developing a management assessment training and simulation system (MATSS), which includes a computer simulation called the "Yugoslav Dilemma," used to assess the decision-making strategy used by executive-level managers. Decision making has been found to be one of the most prevalent factors in organizational management. The major documents produced by this project include:

Swezey, R. W., Streufert, S., Criswell, E. L., Unger, K. W., & van Rijn, P. (1984). Development of a computer simulation for assessing decision-making style using cognitive complexity theory (SAI Report No. SAI-84-04-178). McLean, VA: Science Applications, Inc. (TR 693, Sep 85)

This report is the project final report. It describes the history of the project, theoretical (cognitive complexity theory) rationale for the simulation and its assessment measures, and a complete description of the simulation. Interested readers should refer to this report for an overview and description of the project.

Baudhuin, E. S., Swezey, R. W., Foster, G. D., & Streufert, S. (1980). An empirically derived taxonomy of organizational systems (SAI Report No. SAI-80-091-178). McLean, VA: Science Applications, Inc. (TR 692, Sep 85)

This document describes the factor-analytic procedures used to cluster and rank order over 350 variables involved in systems theory and organizational management. The procedure yielded six factors. Factor one was Multidimensional Information Processing, including decision making. This factor led to the decision-making emphasis of the simulation.

Swezey, R. W., Davis, E. G., Baudhuin, E. S., Streufert, S., & Evans, R. A. (1980). Organizational and systems theories: An integrated review (SAI Report No. SAI-80-113-178). McLean, VA: Science Applications, Inc. (TR 595, AD A139 796, Sep 80)

This 300-page literature review provides an integrated discussion relating the diverse fields of organizational and systems theory. Its contents are organized according to the taxonomy developed in B Baudhuin, Swezey, Foster, and Streufert (1980).

Unger, K. W., & Swezey, R. W. (1983). Programmer's manual to accompany the Yugoslav Dilemma (A computer simulation). (SAI Report No. SAI-83-08-178). McLean, VA: Science Applications, Inc. (RN 84-56, Feb 84, AD A141 716)

This manual describes the eight programs that run the Yugoslav Dilemma. Each program is listed and annotated. Various possible program manipulations are described.

Criswell, E. L., Unger, K. W., Swezey, R. W., & Streufert, S. (1984). Researcher's manual to accompany the Yugoslav Dilemma (A computer simulation) (SAI Report No. SAI-84-02-178). McLean, VA: Science Applications, Inc. (RN 84-57, Feb 84, AD A141 720)

The manual (1) explains the researcher's responsibilities in running participants through the simulation, (2) describes all materials necessary to operate the simdulation, (3) provides step-by-step operating procedures, and (4) presents instruction for interpreting participant profiles.

Criswell, E. L., Unger, K. W., & Swezey, R. W. (1984). Participant's manual to accompany the Yugoslav Dilemma (A computer simulation) (SAI Report No. SAI-84-03-178). McLean, VA: Science Applications, Inc. (RN 84-58, Feb 84, AD A141 753)

This manual presents (1) instructions on how to interact with the computer during the simulation, and (2) fictional background information to set the stage for the Yugoslav Dilemma.

DEVELOPMENT OF A COMPUTER SIMULATION FOR ASSESSING DECISION-MAKING STYLE USING COGNITIVE COMPLEXITY THEORY

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DEVELOPMENT OF A COMPUTER SIMULATION FOR ASSESSING DECISION-MAKING STYLE USING COGNITIVE COMPLEXITY THEORY

PROJECT OVERVIEW AND SIMULATION DEVELOPMENT

This document is the final report on a project involving the development of a microcomputer-based Management Assessment and Training Simulation System (MATSS). The project was conducted over a period of three and one-half years, and resulted in the development of the MATSS simulation and numerous reports and technical memoranda. Major documents are listed in the Introductory Statement section of this report.

The MATSS project, like many multiyear research efforts, evolved considerably during the period of performance. This overview describes that evolution.

Rationale Development

Originally the project was entitled "Development of a Systems Test Bed and Methodology for Organizational Research," and it was intended that the project would establish a test bed wherein organizational simulations could be conducted and researched. Based upon the outcomes of these activities, organizational effectiveness and management strategies could be identified for the overall purpose of improving organizational functioning in the military environment.

As a preliminary step to accomplishing this task, a taxonomy of organizational and general systems theory concepts was constructed, and literatures on organizational and systems theory concepts were reviewed in terms of this taxonomy. This work is discussed in the following reports: taxonomic development (Baudhuin, Swezey, Foster, & Streufert, 1980); annotated bibliography (Davis, Foster, Kirchner-Dean, & Swezey, 1980); and literature review (Swezey, Davis, Baudhuin, Streufert, & Evans, 1980).

Additionally, it was determined that the preferred test bed methodology should involve a simulation-based scenario. Various alternative approaches were therefore reviewed, resulting in the suggestion that a "quasi-experimental" simulation technique (which combined features of free simulations, where participants are free to choose their own course of action, with experimental simulations, where rigorous experimental control is exercised over participant response activities) was the technique of choice. The rationale for this decision, as well as definitions of the terms "free," "experimental," and "quasi-experimental" in this context, was discussed in a report by Streufert and Swezey (1980).

The taxonomic development effort undertaken as an early aspect of the project resulted in the development of an empirical approach to taxonomy development wherein a data base of topic areas addressing organizational and systems theory constructs was subjected to a series of factor analytically

based procedures. These activities yielded a taxonomy whose structure was defined in terms of the factor loadings of the extracted factors. Six final factors were identified in this analysis. In decreasing order of importance, the factors were: Multidimensional Information Processing, Organizational Systems Dynamics, Organizational Change Technologies, Management Authority/ Compliance Characteristics, Organization Coordination and Control, and Goal Orientation. Baudhuin et al. (1980) provide a description of the rationale, methodology, and results of the factor analytically based taxonomic development portion of the project.

Based upon the results of the taxonomic development activity, and upon the resulting annotated bibliography (Davis et al., 1980), and literature review (Swezey et al., 1980), it was concluded that the area of interest for the test bed scenario development should be the topic of Multidimensional Information Processing, particularly as it relates to the interactive complexity theory developed by Streufert and Streufert (1978). The rationale for this conclusion rested upon the factor structure of the lead factor extracted from the factor analysis. This lead factor consisted of such interactive complexity theory constructs as integration, complexity, output, information, differentiation, and decision making, among others. Swezey et al. (1980) provide a discussion of the research needs derived from the taxonomy-based literature review.

Hardware and Software Development

During the period in which the taxonomic development and literature review activities were proceeding, various alternative locations for the test bed were considered, ranging from an instrumented room at the contractor's facility (Science Applications, Inc. in McLean, Virginia) to location on an actual operating Army facility. Since the area of interest for scenario development centered around managerially oriented multidimensional (i.e., complex) information-processing activities, various Army management institutions were contacted with regard to the possibility of ultimately integrating the project activities with their requirements. These contacts resulted in detailed discussion with the U.S. Army War College (USAWC) during 1980 and 1981. It was determined that project activities should begin the development of a vehicle which might be of utility at the College in its role of providing management education to Army officers. For this reason, it was determined that a microcomputer-based simulation would be developed which would address complex strategic decision-making activities in a realistic scenario. The simulation should further allow for the development of an assessment component wherein decision strategies employed by participants to solve scenario-based problems might be assessed in terms of interactive complexity theory constructs. Accordingly, subsequent activities were devoted to determining the particular type of microcomputer configuration to be used in the project. An analysis of this issue, comparing various options on the basis of anticipated hardware requirements, as well as cost considerations, resulted in the selection of an Apple II Plus system for use as the scenario presentation vehicle. This analysis and the basis for the conclusion to use an Apple system are documented in a technical memorandum (Atwood & Swezey, 1981).

At this time also, attention was devoted to the choice of a scenario for simulation use, and discussions with USAWC personnel suggested that an international political-military scenario was a preferred option. Fortunately, the basis for such a scenario existed in a manual game which was available at USAWC. This game, in a classified version, has been utilized at USAWC as an instructional technique in international decision-making activities. An abbreviated, declassified version of this hypothetical political-military scenario known as the "Yugoslav Dilemma" was therefore provided by USAWC as the basis for simulation development on this project. Considerable modification and expansion of this scenario was required in order to render it suitable for use in a microcomputer-based format, and in order to allow for the development of the component of the effort which included a capability to assess participant decision-making styles. Literally hundreds of decision alternatives were developed to allow for adequate participant decision selection latitude, and to enable the simulation to have the capability to vary the number of scenario-based messages presented to participants. Message preparation was varied according to known parameters designed to be compatible with the Streufert and Streufert (1978) theoretical statements concerning the interactive complexity constructs, previously determined to be of interest to the effort.

In accomplishing this activity, preliminary and variously iterated and improved versions of the Yugoslav Dilemma scenario were constantly reviewed by in-house experts in three technical areas: decision-making and information-processing activity, eastern European politics, and U.S. strategic threat analysis. This activity resulted in a dramatically expanded and adapted version of the Yugoslav Dilemma, documented in preliminary form by Unger and Swezey (1982a), and in final form by Criswell, Unger, and Swezey (1983b).

Simulation Documentation

During the developmental portion of the project, two additional activities were undertaken. One of these (Streufert & Swezey, 1982) reviewed the recent literature (i.e., post-1978) on cognitive complexity theory and research, and developed a measurement strategy for assessing this construct in the context of the microcomputer-based Yugoslav Dilemma simulation. Various alternative measurement approaches were presented and discussed in this document and a preliminary rationale was outlined for the development of the microcomputer-based measurement techniques adapted for use in this project. This report was updated, revised, and expanded in a subsequent document by Criswell, Swezey, and Streufert (1983a).

The second activity concerned documentation of the complex software employed in the MATSS. Unger and Swezey (1982b) have presented a discussion of the software and supporting documentation for the MATSS in preliminary form; a revised, expanded, and updated Programmer's Manual was subsequently developed (Unger & Swezey, 1983). This document provides information in four categories: (1) a documented listing of simulation programs, (2) instructions for manipulating key system variables, (3) a description of system hardware, and (4) detailed examples of how participants' responses to the MATSS simulation are measured and calculated.

Since the MATSS as currently configured must be set up and administered by a competently trained researcher/administrator, a Researcher's Manual was prepared by Criswell, Unger, Swezey, and Streufert (1983c). This document provides step-by-step instruction for setting up and running the Yugoslav Dilemma, and the practice session scenario (known as "Storm"), as well as a description of how the computer-based measurement programs generate participant decision-making profiles and preliminary guidance on interpretation of these profiles. (It should be noted that since MATSS has not been run on large samples, and since the computer-generated measurement profile scoring techniques have not been validated, any information on participant profile analysis must be considered preliminary and tentative.)

Similarly, considerable background information and knowledge concerning both the scenario context and equipment operation procedures are required of MATSS participants. Therefore, a Participant's Manual has been developed to accompany the Yugoslav Dilemma scenario (Criswell et al., 1983b). This document presents simulation introduction, instructions for participation, and background information on Yugoslavia. Step-by-step instructions are included for: (1) receiving messages in the Yugoslav Dilemma and Storm scenario practice session, (2) entering decisions into the computer, and (3) use of decision-making aids included with the Yugoslav Dilemma scenario.

The MATSS project has resulted in an innovative, theory-based, microcomputer-adapted complex decision-making simulation employing a hypothetical political-military scenario in Yugoslavia. It has been extensively documented, and has involved complex programming activity in order to adapt it to an Apple II Plus microcomputer system. It has not, however, been exercised in any large-scale sense, nor have the computer-generated participant measurement profiles been subjected to an empirical validation. The potential exists here for a management decision-making assessment vehicle of considerable theoretical and practical importance. Validation and large-scale tryout activities, however, remain to be accomplished.

THEORETICAL BASIS OF THE MATSS

Interactive Complexity Theory

Introduction. As mentioned in the preceding section, the theoretical basis for the MATSS is derived from interactive complexity theory (Streufert & Streufert, 1978). Interactive complexity theory is one of several social-psychological theories of cognitive complexity. Cognitive-complexity theories attempt to describe the structure of cognitive information processing and differences in that structure across groups of individuals.

Interactive complexity theory describes the structure of cognitive information processing as a function of the interaction of the complexity ability of individual and environmental variables. The theory includes the concepts of behavioral (or cognitive) complexity and environmental complexity. Behavioral complexity refers to complexity in information processing, or decision making; complex decision making is based on combinations of information from a variety of sources, not just on a single bit of information from a single source. Environmental complexity refers to the amount of

information available in the environment. Environments range from low (information underload) to high (information overload) in environmental complexity. These concepts are discussed in more detail later in this section.

Other cognitive complexity theories have been described elsewhere (Streufert & Streufert, 1978; Streufert & Swezey, 1982). Definitions of complexity vary from theory to theory. For example, a complexity theory called personal construct theory concerns the way people form judgments called "constructs" (Bieri, 1966; Kelly, 1955). In this theory, complexity refers to the number of constructs a person relates in forming social judgments. Another theory, called categorizing theory, employs a basic unit called a "category" which is an attribute (or held opinion) assigned by one individual to another (Zajonc, 1960). Each category is a member of a class of categories. According to this theory, complexity concerns the number of classes to which an individual states any category could belong. Cognitive structure theory proposes a geometric model of cognitive complexity where complexity represents the number of dimensions (judgments) onto which a given object is projected (Scott, 1963, 1969, 1974; Scott, Osgood, & Peterson, 1979). Each complexity theory has its own measurement procedures according to its definition of complexity. The interested reader should consult Streufert and Streufert (1978) for more information.

The remainder of this section describes interactive complexity--its structural nature, important terminology, the role of the environment, and categories of cognitive complexity. This section is followed by a discussion of the measurement of complexity according to interactive complexity theory.

Structure versus Content. Interactive complexity theory is concerned with the structure, not the content of information processing. Structure refers to patterns of relationships, or the "how" of information processing. Content refers to substance, or meaning, the "what" of information processing. In the area of decision making, interactive complexity theory is, therefore, concerned with structural aspects such as the number of sources of information requested, the number of pieces of information used in each decision, use of a plan of action, and level of complexity of the plan. Content aspects, such as fairness, effectiveness, or cleverness of the decision, are not considered by this theory.

All of us make decisions nearly all of the time. Most of these decisions are minor, are based on previously established habits (selecting food is an example), and much of the time we are not even aware that we have just made a decision. Most of our decisions differ in their content; the decision whether to have a sandwich or a salad, and the decision to take the train or to fly differ greatly. As a result, it is difficult to scientifically analyze decision content (i.e., is it better to eat a sandwich or a salad? is it better to ride or to fly?) unless we restrict ourselves to some limited range of decisions. For example, if we are concerned about health, we might safely say the decision not to smoke is better than the decision to smoke. However, for most decisions made on a day-to-day basis, contents are so diverse that qualititative comparisons are difficult to make.

Further, as situations become more complex, it becomes correspondingly more difficult to evaluate the quality of decisions. For example, is it

better to purchase two new tanks this year or wait and purchase three new tanks next year? While we may be able to make a decision based on cost alone, a myriad of factors could be used in assessing the content or quality of such a decision. Content questions are difficult to study.

Decision structure, on the other hand, provides an opportunity for scientific study. The structural approach considers how decisions are made rather than what decisions are made. In determining the "how" of decision making, we can analyze whether decisions are related to each other in a strategy, to how many goals they relate, and whether the decision maker approaches the task in terms of some overall interactive system or operates on several unrelated subsystems. Interactive complexity theory is a structural theory, and seeks to uncover patterns in decision making.

Terms. Several terms are important in interactive complexity: dimension, discrimination, differentiation, integration, unidimensional, and multidimensional. Theoretical explanations of these terms have been presented elsewhere (c.f., Streufert & Streufert, 1978). The definitions here have been operationalized to the extent possible; these terms all apply to cognitive (therefore inaccessible) activity, but observable behavioral correlates of the cognitive processes may be described.

A dimension is a characteristic of something (object, person, event). A dimension is represented by a bipolar scale such as good to bad, short to tall, or friendly to hostile. Individuals perceive things using their own unique dimensions; for example, one person may react to a school building with the dimension old-new, another person may react with the private-public dimension.

Discrimination is the process of dividing dimensions, thereby adding points to the bipolar scale. For example, discriminations on the dimension of hot-cold might include lukewarm, tepid, warm, and cool.

Differentiation is the process of generating additional scales or dimensions with which to judge something. These scales do not overlap; for example, fair-unfair and friendly-hostile are two separate dimensions, but fair-unfair and very fair-very unfair probably lie along the same dimension. (Very fair-very unfair are examples of discriminations on the fair-unfair dimension.)

Integration is the process of relating two or more dimensions to produce an outcome (such as a decision) which is based on all dimensions involved. An integrated decision need not represent each dimension equally; it need only represent each dimension to some extent.

Differentiation, then, must precede integration. Differentiation does not always lead to integration, but often does. Discrimination, on the other hand, does not usually lead to differentiation. Discrimination may lead to more discrimination. In fact, a discriminator usually discriminates more than a person who differentiates or integrates.

Integration itself may be described with the dimension of hierarchical-flexible. Hierarchical integration refers to a routine integrated decision

resulting from the application of the same dimensions to a variety of situations. An example might be the decision to always ask for three pieces of advice before taking action in any situation. In contrast, flexible integration occurs when dimensions are related anew for each situation.

The dimension known as unidimensional-multidimensional is a characteristic of an individual's information processing. A unidimensional individual tends to form judgments and make decisions based on one or only a few dimensions; differentiation is at low levels and integration is zero or near zero. A multidimensional individual employs many dimensions when making decisions; differentiation and integration are usually at moderate to high levels. Multidimensional individuals consider many different dimensions and shades of meaning. There are two broad types of multidimensional individuals; differentiators who differentiate, but do not usually integrate, and integrators who differentiate and integrate.

Environmental Influences. As mentioned earlier, interactive complexity theory holds that the behavioral complexity (use of differentiation and integration) of an individual is a function of the interaction between ability and environmental complexity. According to the theory, the environment contains certain variables which influence behavioral complexity; the two most important variables are information load and success or failure.

Information load is the amount of information operating on an individual at any one point in time. Information is something in the environment that is capable of producing a response from the person receiving the information. Amount of information load ranges from low to high, and according to interactive complexity theory, the amount of load influences amount of behavioral complexity. Further, information load affects behavioral complexity differentially for uni- and multidimensional individuals.

Figure 1 illustrates the relation between behavioral complexity and information load. Inverted U-shaped functions are obtained. As shown, at low load levels (which may be described as underload or deprivation), neither uni- nor multidimensional individuals engage in much differentiation or integration. At low load levels, the environment is not stimulating or challenging. As load increases, however, behavioral complexity increases, more so for multi- than for unidimensional people. As shown, some intermediate load level is optimal for the use of differentiation and integration. The optimal load level for unidimensional individuals is lower than the load level for multidimensional individuals. Again, unidimensional people employ differentiation and integration much less than do multidimensional people. As load increases past an optimal level, behavioral complexity decreases. Environments too loaded with information are difficult ones in which to make complex decisions.

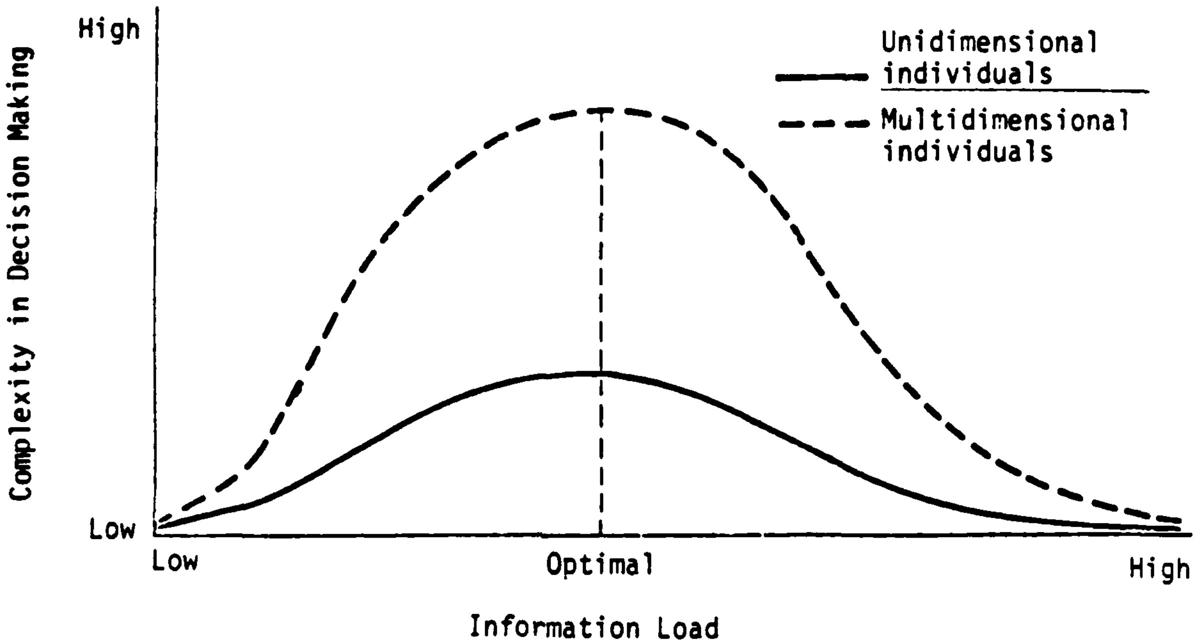

Figure 1. Amount of differentiation and integration in decision making as a function of information load. (From Overview of cognitive complexity theory employed in a Managerial Assessment and Training Simulation System by Siegfried Streufert. Presented at the 1982 Annual Convention of the American Psychological Association. Washington, D.C., 1982. Adapted by permission).

In summary, as shown in Figure 1, interactive complexity theory holds that unidimensional people employ a unidimensional decision-making style in nearly all situations.[1] In contrast, multidimensional people differentially employ various decision-making styles depending on the situation (Streufert, 1970). Some environments provide multidimensional people an opportunity to employ multidimensional strategies, and some environments do not. Environments which do not foster multidimensional strategies are stressful in some way, due to such things as deprivation and information overload (Streufert & Streufert, 1978).

Optimal environments for use of multidimensional decision-making strategies contain the following characteristics:

- provide an optimal amount of information, in the sense that they neither underload nor overload the decision maker,
- challenge the decision maker in the sense that the content of the situation does not suggest a clear-cut path of action,
- allow enough time for the development and execution of strategy.

Figure 2 presents the effects of information load on four types of responses: integrated, differentiated, one-to-one, and irrelevant. <u>Irrelevant</u> responses are responses which do not appear to relate to salient environmental conditions. <u>One-to-one</u> responses (also called respondent decisions) occur in direct, immediate response to environmental conditions. These responses are not systematic or planned. <u>Differentiated</u> responses are those that act along a number of dimensions, but in an unplanned fashion. For example, if a differentiator meets person X, the differentiator may act to find information about the person on a number of dimensions (e.g., age, occupation, intelligence), but no action would be planned, and the information would not be sought in a logical progression. <u>Integrated</u> responses relate differentiated responses to each other in a planned or systematic way.

As shown in Figure 2, changes in environmental load affect changes in the four types of responses. Irrelevant responding is highest when load is either low or high, and lowest at intermediate levels. One-to-one responding is a direct function of load from low to high information load levels, with very high levels being obtained at high load levels. Differentiated responses are lowest at low load levels, rise quickly with increase in load, reach highest value at an intermediate load level, then taper off slightly, but still remain high at higher load levels. Finally, integrated responses form an inverted U-function of information load. Integrations occur least

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[1] Strictly speaking, people should not be described as purely unidimensional or multidimensional. A better label might be "more unidimensional" or "more multidimensional" to indicate that a person behaves more unidimensionally than multidimensionally, and so forth. In this report, however, people are described as uni- or multidimensional to avoid confusion due to the grammatical imperative that comparatives (such as "more") must be explained each time they are used.

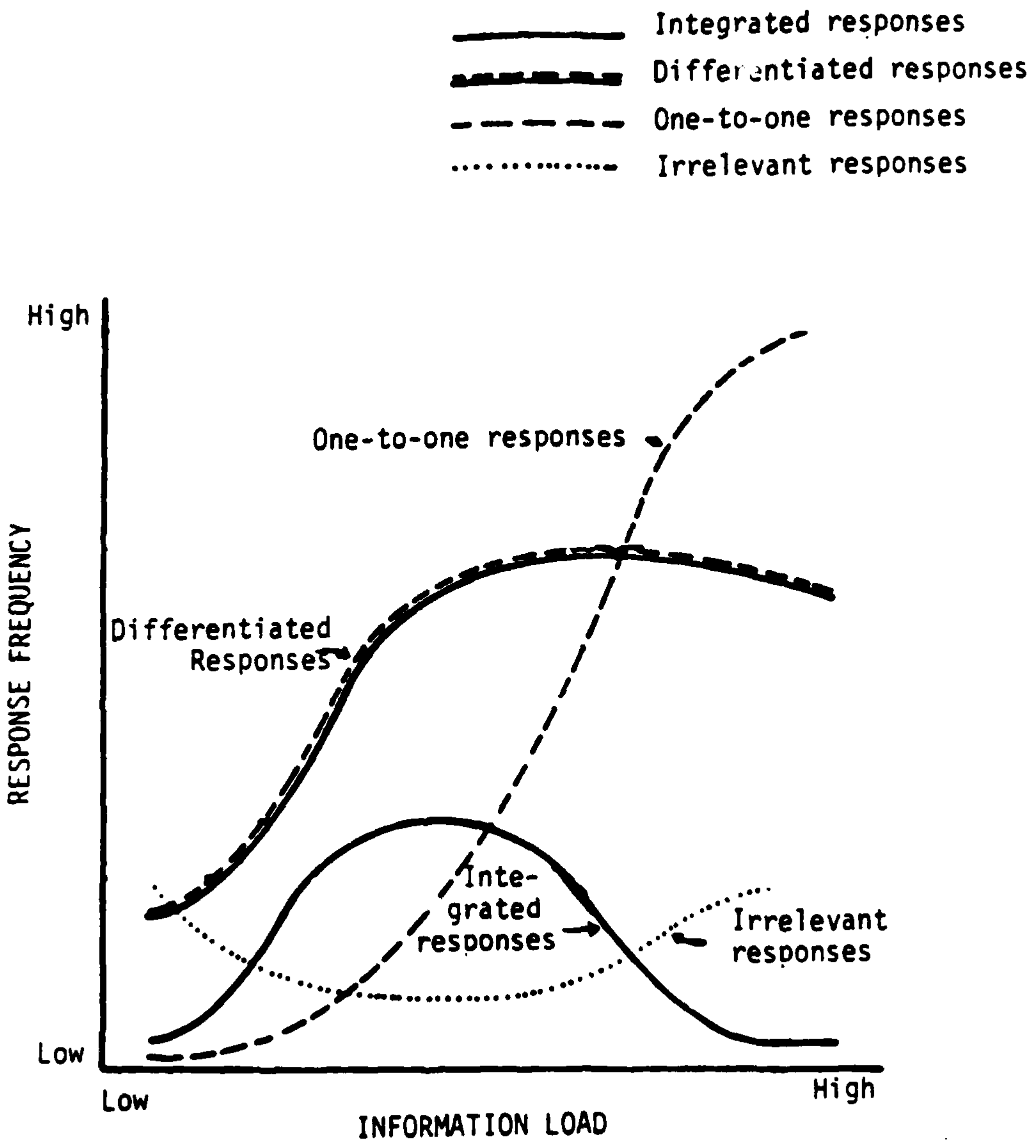

Figure 2. Effects of information load on frequency of four kinds of responses. (From Behavior in the Complex Environment, p. 109, by S. Streufert and S. C. Streufert, 1978, Washington, D.C.: V. H. Winston & Sons, Copyright 1978 by V. H. Winston & Sons. Adapted by permission).

frequently at both low and high load levels, and occur most frequently at an intermediate load level. The optimal load for integrated responses is slightly less than that for differentiated responses.

Figure 2 also shows that the load value at which most frequent responding is obtained is different for the four types of responses. From low to high values, low values produce irrelevant responding; slightly higher values produce both differentiated and integrated responding; slightly higher values produce differentiated but not integrated responses; high values produce high levels of one-to-one responding. Differentiated responses remain high also. As shown in Figure 2, many environments produce moderate levels of differentiation.

The shape of the functions in Figure 2 is similar for both uni- and multidimensional individuals (Streufert & Streufert, 1978). The frequency values, however, differ for these groups.

According to interactive complexity theory, a second salient environmental variable, in addition to load, is success and failure. The theory makes predictions concerning the effects of success and failure on behavioral complexity (Streufert & Streufert, 1978). The theory predicts that success results in decreased complexity because the person searches less for correct action once a successful course has been established. Failure, on the other hand, causes a person to increase load in an attempt to find a course of action which will be well received. The theoretical rationale for the effects of success and failure is much less developed than that for information load.

Categories of decision makers. Interactive complexity theory predicts nine categories of decision makers (Streufert & Streufert, 1981). Two categories pertain to undimensional individuals, and seven pertain to multidimensional individuals. Figure 3 presents the categories and how they relate to each other. The categories are briefly described below.

The low unidimensional decision maker usually responds to nearly all environmental conditions with the same dimension (such as good-bad) or only a small number of dimensions. Discriminations within the dimensions are usually not made.

The normal unidimensional decision maker is like the low unidimensional decision maker except that discriminations within the dimensions employed are made. Thus, if black-white is a frequently applied dimension, a thing need not be judged as either black or white; it may be gray. In addition, there is occasional differential use of dimensions. For example, efficiency-inefficiency may be applied to a business issue, and moral-immoral to a religious issue.

All the remaining categories apply to multidimensional individuals. In each category, the decision maker consistently uses a moderate to high number of dimensions in decision making.

The general differentiator employs several dimensions in decision making, but never relates these dimensions to each other. The dimensions are viewed as unrelated or mutually exclusive. Dimensions are differentiated, but

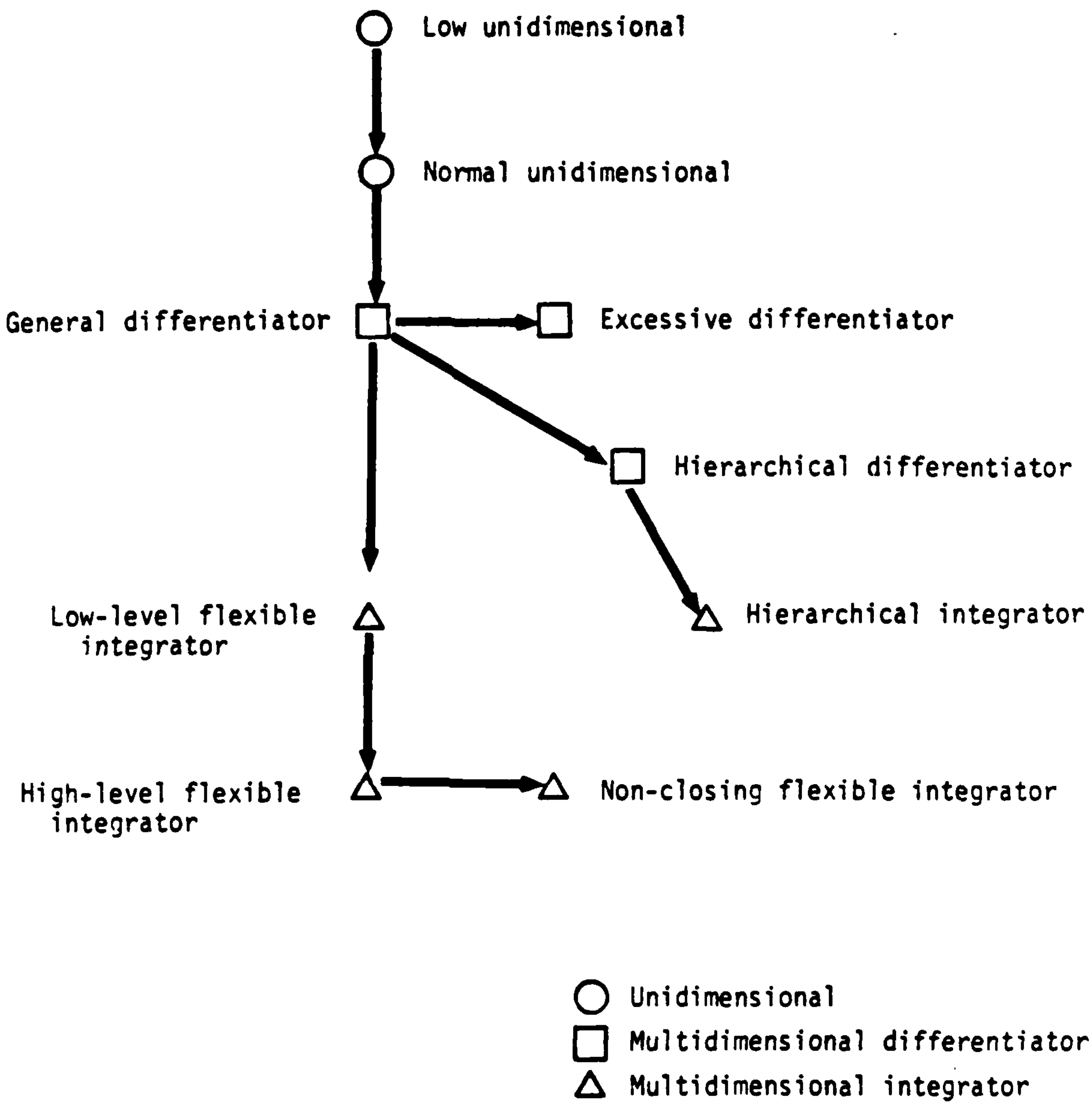

Figure 3. Categories of decision makers predicted by interactive complexity theory.

infrequently integrated. For example, a general differentiator might employ the dimensions expensive-inexpensive and effective-ineffective to judgments about a federal social program, but would not relate the dimensions to each other to form a summary. It may never occur to the decision maker that a program may be both expensive and ineffective. Different dimensions may or may not be employed in various settings. Categories of differentiators differ from the unidimensional categories in that more dimensions are employed.

The excessive differentiator generates an inordinately large number of dimensions, but never comes to integrated decisions.

Two branches leading from general differentiator contain hierarchical and flexible categories. The hierarchical differentiator employs the same dimensions when judging a wide variety of things. For example, an individual in this category might judge most things using the dimensions good-bad, fair-unfair, moral-immoral. These dimensions do not change.

The hierarchical integrator arrives at integrated decisions, but decisions are similar all the time regardless of the dimensions involved. Further, an individual in this category is not likely to reconsider new dimensions and alter a decision. New dimensions would be interpreted as supporting the original decisions.

As shown in Figure 3, there are three categories of flexible integrators. The low-level flexible integrator generates multiple dimensions (like the general differentiator), but after making an integrated decision may consider additional dimensions. Information which appears discrepant may be reconsidered, not simply ignored. In addition, a superordinate dimension may be used to combine the dimensions. An example of such a superordinate dimension might be significant-nonsignificant. A person may take available dimensions (which do not include significant-insignificant) and come to an integrated decision which addresses significance.

The high-level flexible integrator is like the low-level flexible integrator except the high-level integrator uses more superordinate dimensions.

The non-closing flexible integrator generates high-level integrations, but considers those decisions as tentative and has trouble acting. This individual's information processing is complex, but final conclusions are delayed. This person differs from the excessive differentiator who generates dimensions but no integrations.

Finally, Streufert and Streufert (1978) make the important point that no one category is "better" than another. It appears that the utility of a decision-making style depends on the situation. Multidimensionality has value in situations where behavior should proceed in a flexible way, where a large number of stimuli must be taken into account, and where alternatives which may overlap have to be considered. On the other hand, unidimensionality would be an advantage where decisions have to be made according to a clear criterion, where rapidity of action is required, where alternative interpretations of the same set of stimuli would be viewed as needless and inefficient. A multidimensional person living on a farm in some small community of an

underdeveloped country with a stable culture would probably be maladapted if he or she displayed the multidimensionality useful in a cosmopolitan city. Even in complex societies, people who cling steadfastly to simple judgments may be at times better off than those who come to too many alternate conclusions. Most successful, however, are probably those who change their dimensionality with the demands of the environment.

Measurement of Interactive Complexity

Interactive complexity has been measured in three ways. Two subjective measures, the Sentence (or Paragraph) Completion Test (SCT) and the Impression Formation Test (IFT), have been validated and widely used in research. (For SCT validation data, refer to Driver [1965]; Schroder, Driver, and Streufert [1967]; Schroder and Streufert [1962]; Sieber and Lanzetta [1964]; Stager [1967]; Streufert and Driver [1965]; Suedfeld and Streufert [1966]; and Tuckman [1966]. For IFT validation data, refer to Streufert and Driver [1967].) Both tests lead to scores for differentiation and integration separately. The third measure, the Time-Event Matrix (TEM) is objective, but has not been widely researched. The TEM includes such components as integrations in strategic decision making (Streufert, 1983; Streufert, Clardy, Driver, Karlins, Schroder, & Suedfeld, 1965; Streufert & Schroder, 1965). All three measures assess the structure of an individual's information processing, then assign a category of complexity based on the structure.

Sentence (Paragraph) Completion Test (SCT). The SCT is the most frequently used of the three measures (Schroder & Streufert, 1962). Subjects write paragraph-length responses to eight (in the most recent version) sentence stems such as "When I am criticized....," and "When I am not sure what decision I should make...." The sentence stems provide conflict situations to which subjects can respond uni- or multidimensionally. Scoring guidelines for early test versions may be found in Schroder and Streufert (1962). A training course in scoring recent versions typically results in observer agreement scores of .85 or better. Recent versions may be scored for both differentiation and integration, separately, for complexity in four contexts: social, nonsocial, perceptual, and executive.

Impression Formation Test (IFT). The IFT requires subjects to write at least four sentences to describe three people. On one version of the test, the first person to be described is someone who is "intelligent, industrious, and impulsive." The second person to be described is "critical, stubborn, and envious," and the third person is "intelligent, industrious, impulsive, critical, stubborn, and envious." Other forms of the test with different adjectives are available (Streufert & Driver, 1967). The tests may be scored for both differentiation and integration, separately (Schroder, Driver, & Streufert, 1967; Streufert & Driver, 1967). Scores on the IFT are positively correlated with scores on the SCT (Streufert & Driver, 1967). In addition, both tests have predictive validity for scores on other measures; see Streufert and Streufert (1978) and Streufert and Swezey (1982) for more information.

Time-Event Matrix (TEM). The TEM was developed to display decision-making structure as measured by interactive complexity-based decision-making simulations (Streufert, 1983; Streufert et al., 1965; Streufert & Schroder,

1965). Individuals are presented with a problem situation and given the opportunity to collect information, take action, and plan to solve the problem. Thus, individuals may behave uni- or multidimensionally. A variety of structural measures may be generated by decision-making simulations and displayed on TEMs (Streufert, 1983). The example TEMs described in this report include one-to-one, differentiated, and integrated responses (defined earlier).

Figure 4 shows a TEM for a normal unidimensional decision maker. Time is on the horizontal axis, decision types (a simulation's "dimensions") on the vertical axis. Decisions are represented by ●. One-to-one responses are represented by •—● where • is receipt of information and ● is the response. Differentiated responding is indicated by the number of decision types executed by the subject. Integrated decisions are connected by diagonals; diagonals pointing forward reflect advance planning, and diagonals pointing backward represent relations seen between decisions only in retrospect. The TEM in Figure 4 for this normal unidimensional decision maker contains frequent and rapid one-to-one responding, low number of decision types, and little integrated responding. Many integrations are backwards. For the decision types selected, there are several decisions (representing discriminations) executed within a decision type.

Figure 5 presents a TEM for a sample excessive differentiator. This TEM contains a large number of decision types (or differentiations), but only one or two decisions (discriminations) per type. This TEM contains only two integrations and many isolated decisions. For one-to-one responding, the time from information to decisions is slower than was the case with the unidimensional decision maker.

Figure 6 presents a TEM for a sample high-level integrator. In contrast to Figures 4 and 5, this TEM contains little one-to-one responding, a wide range of decision types selected, and numerous integrated responses. Only a very small portion of the decisions are isolated.

Research on Cognitive Complexity

Measures of interactive complexity, the SCT and IFT, are significantly correlated with each other (Streufert & Driver, 1967). However, other measures of cognitive complexity, based on theories other than interactive complexity theory, do not correlate well with each other or with the SCT and IFT. Reviews of correlation studies may be found in Goldstein and Blackman (1978) and Streufert and Swezey (1982).

In addition, regardless of the complexity measure used, cognitive complexity does not correlate well with other personality variables such as field dependence, dogmatism, authoritarianism (Goldstein & Blackman, 1978; Streufert & Swezey, 1982), or intelligence (Streufert, 1982). Streufert and Streufert (1978) argue that complexity should not correlate with such variables which are all affected by content; none of those variables are structural.

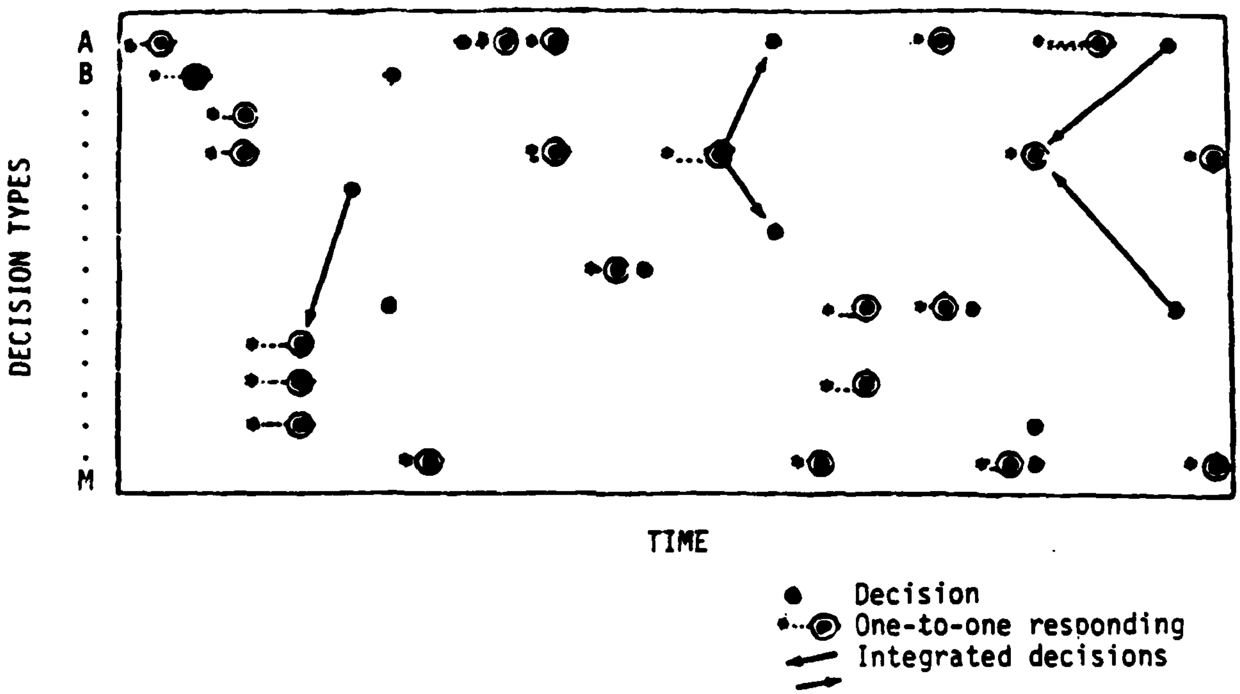

Figure 4. Time-event matrix for a normal unidimensional decision maker. (From "Measurement of Task Performance on the Basis of the Time-event Matrix: An Extension of Methods," by S. Streufert, 1983. ONR Technical Report #12. Adapted with permission.)

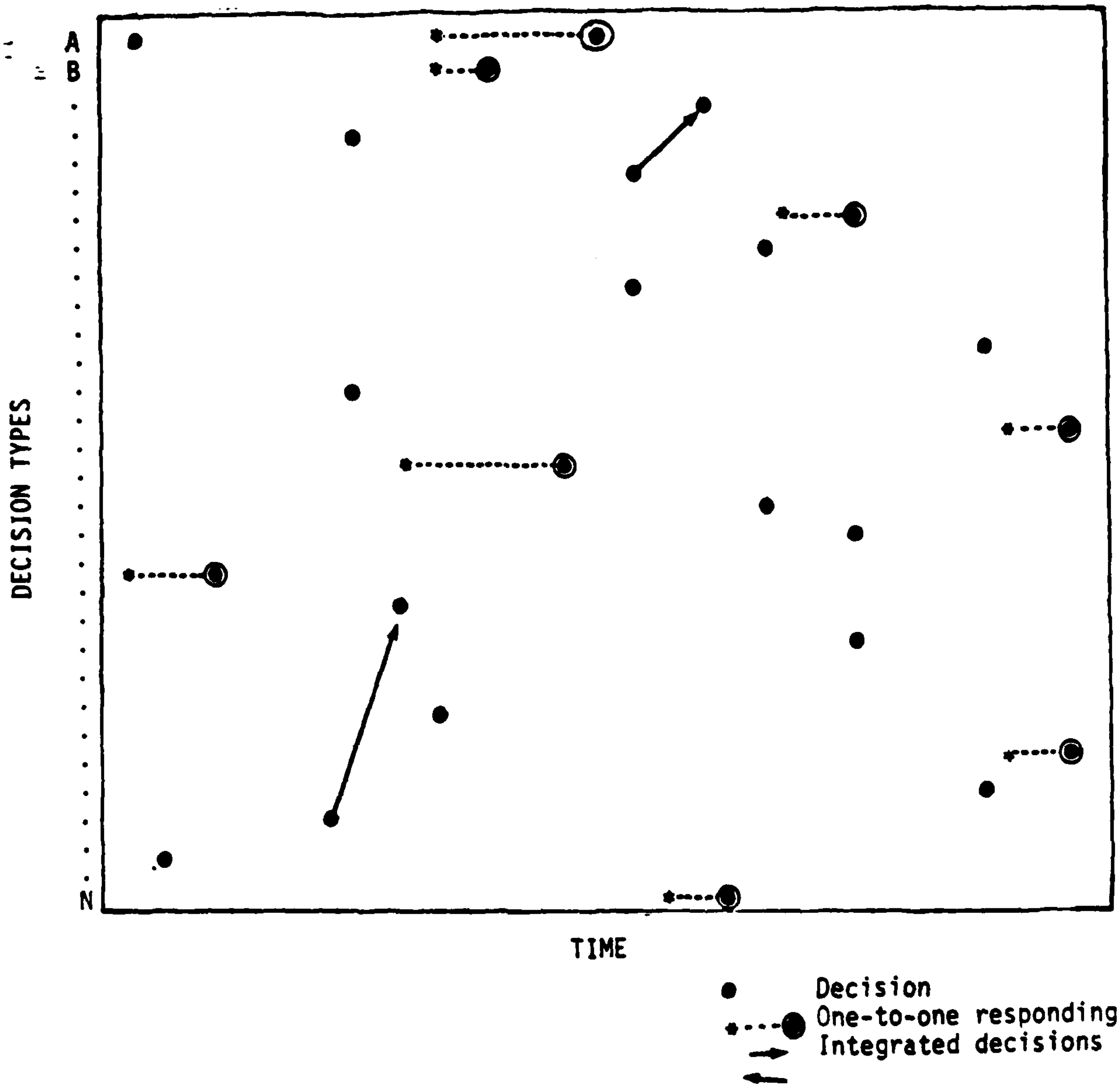

Figure 5. Time-event matrix for an excessive differentiator. (From "Measurement of Task Performance on the Basis of the Time-event Matrix: An Extension of Methods," by S. Streufert, 1983. ONR Technical Report #12. Adapted with permission.)

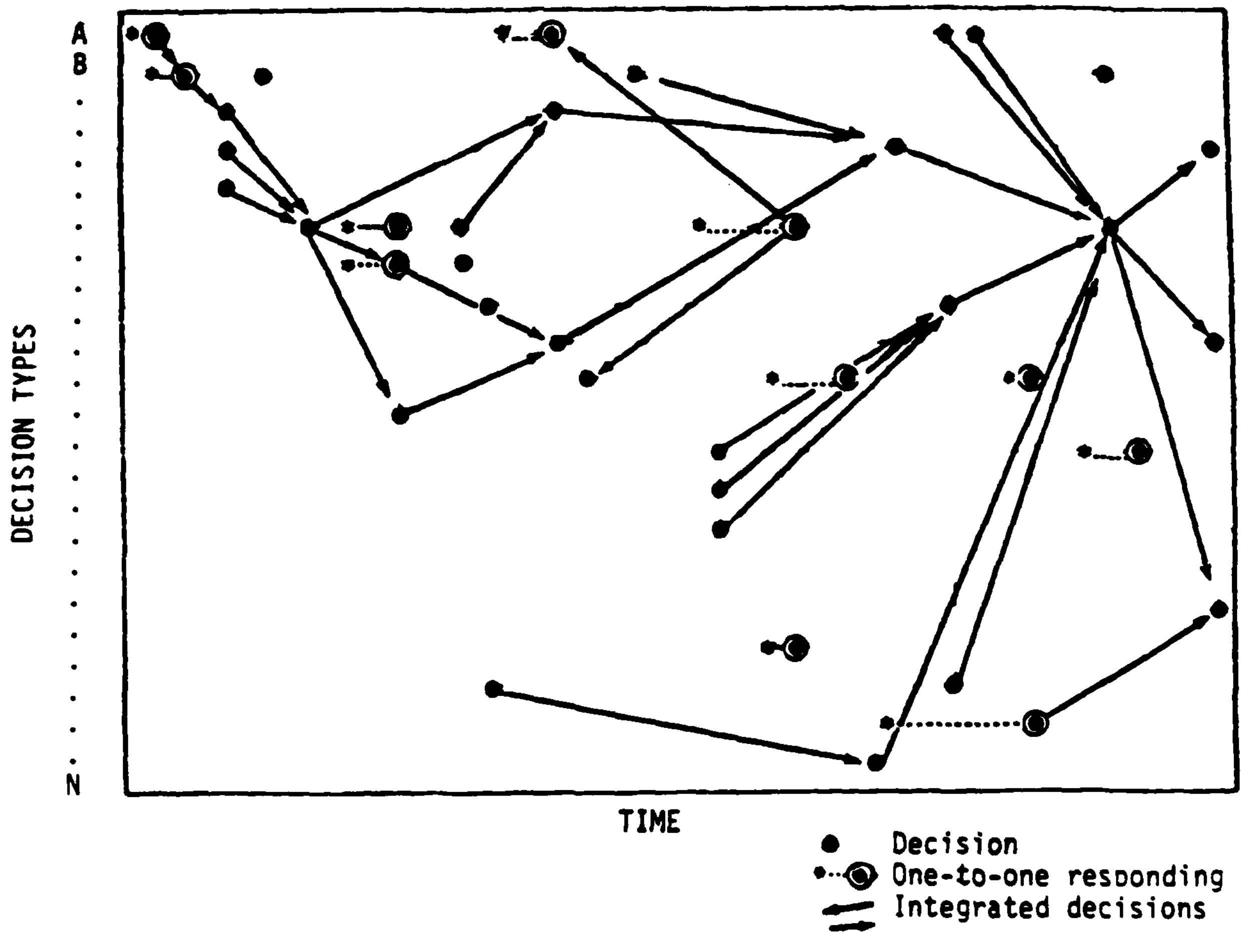

Figure 6. Time-event matrix for a high-level integrator. (From "Measurement of Task Performance on the Basis of the Time-event Matrix: An Extension of Methods," by S. Streufert, 1983. ONR Technical Report #12. Adapted with permission.)

Some researchers assert that the low correlations among complexity measures and between complexity and other construct measures suggest the multicomponent nature of complexity itself. Different measures of complexity may be assessing different component parts of cognitive complexity (Scott, Osgood, & Peterson, 1979; Streufert & Streufert, 1978; Streufert & Swezey, 1982; Vannoy, 1965).

The multicomponent nature of complexity is further suggested by the fact that in spite of low intercorrelations, individuals identified as more or less complex by a variety of tests perform similarly in some experimental situations. For example, regardless of the measure used, less complex subjects strive for consistency (e.g., attraction to people like themselves, poor understanding of contrary events in person perception), whereas more complex subjects do not (c.f., Crano & Schroder, 1967; Harvey & Ware, 1967; Press, Crockett, & Rosenkrantz, 1969; Scott, 1963; Streufert & Streufert, 1978).

Many studies also suggest that more complex persons collect information which they then relate, and seek novel rather than redundant information (c.f., Streufert & Streufert, 1978; Streufert, Suedfeld, & Driver, 1965; Suedfeld & Streufert, 1966; Tripodi & Bieri, 1964; Tuckman, 1966). In addition, individuals appear to be attracted to and happier with individuals of a similar rather than a different complexity category (c.f., Crouse, Karlins, & Schroder, 1968; Johnston & Centers, 1973; Streufert, Castore, Kliger, & Driver, 1967). Thus, complexity measures based on a variety of theoretical positions seem to measure different but highly related processes.

DESCRIPTION OF THE MANAGERIAL ASSESSMENT AND TRAINING SIMULATION SYSTEM (MATSS)

Design of the MATSS

The MATSS emphasis on managerial decision making arose from an extensive survey and review of organizational and systems theory literature to determine broad topics of common importance. As mentioned earlier, a factor analysis procedure was used to weigh and sort the various organizational topics into clusters. The factor analytic approach used was effective in handling the hundreds of organizational variables considered. The approach yielded six clusters and ranked them in order of occurrence frequency. (A non-empirical approach might have yielded less precise cluster definitions, or might have missed clusters of important variables.) The factor accounting for the most amount of variance was Multidimensional Information Processing which includes the concept of integrated decision making. Thus, interactive complexity theory, with its emphasis on integrated decision making and environmental complexity, was seen as an acceptable theoretical basis for the design of the MATSS.

The MATSS is a simulation designed to create an environment which fosters the use of multidimensional strategies by those people who are able to employ them. (Individuals become "able" to employ those strategies by virtue of past training or ability [Streufert & Streufert, 1978].) The MATSS environment is challenging (with no clearly correct plan of action) and allows time to develop and execute plans. The primary scenario (known as the Yugoslav Dilemma) employed in the MATSS contains three periods. Each period contains

30 minutes of simulation time (approximately one and one-half to two hours of real time). At predetermined intervals, the computer presents information related to a hypothetical escalating military crisis in Yugoslavia. The participant selects choices of action from a list of alternative moves. The code number of the action is then entered into the computer. The computer collects and stores data on participant action during all three periods for the purpose of generating measures of decision-making strategy. The main independent variable of interest, information load, is varied across the three periods. In order, the three periods contain medium, low, and high load values. The participant is told that strategy, not simulation outcome, is the variable of experimental interest.

The MATSS was designed to be a "quasi-experimental" simulation, a combination of free and experimental simulations (Streufert & Swezey, 1980). According to Fromkin and Streufert (1976), a free simulation has four characteristics:

1. The simulated environment is complex and a close approximation of the criterion environment.

2. Participants have a large number of response options (are "free" to some extent).

3. Participants respond in order to change the simulated environment.

4. The course of events is determined by both the experimenter and the participant, thus the participant, to some extent, creates both causes (independent variables) and effects.

According to Fromkin and Streufert (1976), an experimental simulation is unlike a free simulation in that:

1. The simulated environment need not necessarily approximate the criterion environment.

2. The number of response options is limited.

3. All events are predetermined by the experimenter.

4. The number of independent variables used is strictly limited.

In the MATSS, the number of response options is large. In addition, both the participant and the experimenter control simulation events. The participant controls events in the sense that the computer delivers specific responses to specific decisions made by the participant over the course of the simulation. It is highly unlikely that any two participants would encounter the same sequence of messages during the simulation. The experimenter controls events in the simulation in the sense that the outcome of the dilemma is not resolved by the end of the simulation no matter what the participant's responses.

In contrast to a free simulation, however, the Yugoslav Dilemma employs a strictly limited number of independent variables which may be manipulated according to known parameters by the experimenter. The Yugoslav Dilemma, then, shares characteristics of both free and experimental simulations.

As mentioned earlier, the MATSS was designed to be a simulation which could both test theoretical principles and have applied utility in assessment and training. Thus, a strictly experimental simulation would have been too limited for applied purposes, and a free simulation would have been too uncontrolled for test purposes. Thus, the quasi-experimental design was developed for the organizational management test bed (Streufert & Swezey, 1980).

In addition to the quasi-experimental design concerns, content specificity was also an issue in construction of the MATSS. The MATSS was originally intended to address organizational effectiveness issues which imply a large and diverse subject matter. Yet the simulation was ultimately to have been an assessment and training device for the U.S. Army War College (USAWC), so simulation content needed to be specific to a probable USAWC training situation. Thus, the simulation is now situation-specific. This level of specificity may have limited the generality of the present MATSS simulation. This is only speculative, however, because the simulation has not been extensively tested.

Materials and Procedures

Hardware. As listed by Unger and Swezey (1983), the hardware and operating manuals used to run the simulation included:

1. Apple II Plus computer. The Apple computer is accompanied by the following manuals:

    a. Applesoft II Basic Programming Reference Manual - Provides in-depth explanations of all Applesoft commands.

    b. The Applesoft Tutorial - Introduces the user to programming techniques.

    c. Apple II Reference Manual - Describes Apple hardware.

2. Microsoft Ramcard and accompanying installation and operating instructions. This card is placed in the Apple's slot #0.

3. Two Apple II disk drives and accompanying DOS (Disk Operating System) Manual. The controller card is installed in the Apple's slot #6.

4. Thunderclock Plus clock card and accompanying installation and operating manual. The clock card is installed in slot #4.

5. Amdek Color I 13" monitor (no manuals).

6. Integral Data Systems 445G printer and accompanying owner's manual.

7. Grappler interface card and cable with accompanying operator's manual. The card is installed in slot #1.

8. Maezon 10 megabyte hard disk, controller card, and cable with accompanying installation and operating instructions. The controller card is installed in slot #5.

With respect to hardware, the Apple's 48K of RAM turned out to be insufficient memory to meet the demands of the simulation. An additional 16K was therefore added. The present 64K of RAM, while sufficient to run the present simulation, restricts flexibility, and there is little RAM left with which to make changes or additions. Plans for future simulation hardware should include more than 64K RAM.

The Storm practice session and the Yugoslav Dilemma simulation programs run using the hard disk drive and one floppy disk drive. The programs which generate decision-making profiles run using two floppy disk drives.

A recommended room arrangement for right-handed participants is discussed in detail by Criswell, Unger, Swezey, and Streufert (1983c). Figure 7 shows a table with a large workspace. A large desk (approximately six feet long and three feet wide) will have enough table space to hold all the equipment and provide clear workspace. Maps may be hung on the adjacent left wall within the participant's eyesight.

The printer may be located on the left of the table. The front of the printer (the side with the label) should face the front edge of the table. The printouts should be easily within the participant's reach, and there should be room for the printout to stack on the table, not on the floor.

The video monitor should sit on top of the Apple computer with the computer near the center of the front edge of the table.

The floppy disk drive should sit on top of the hard disk drive. The floppy disk drive cable is short, so both disk drives must be close to the back of the Apple. The front sides of the disk drives point away from the Apple and sit perpendicular to the Apple. This arrangement accommodates short cable length and leaves an area clear for workspace.

Table space to the right of the Apple is workspace. This space should be large enough for the participant to store the materials and write on the note-taking forms.

Additional human factors guidelines are given in Criswell et al. (1983c).

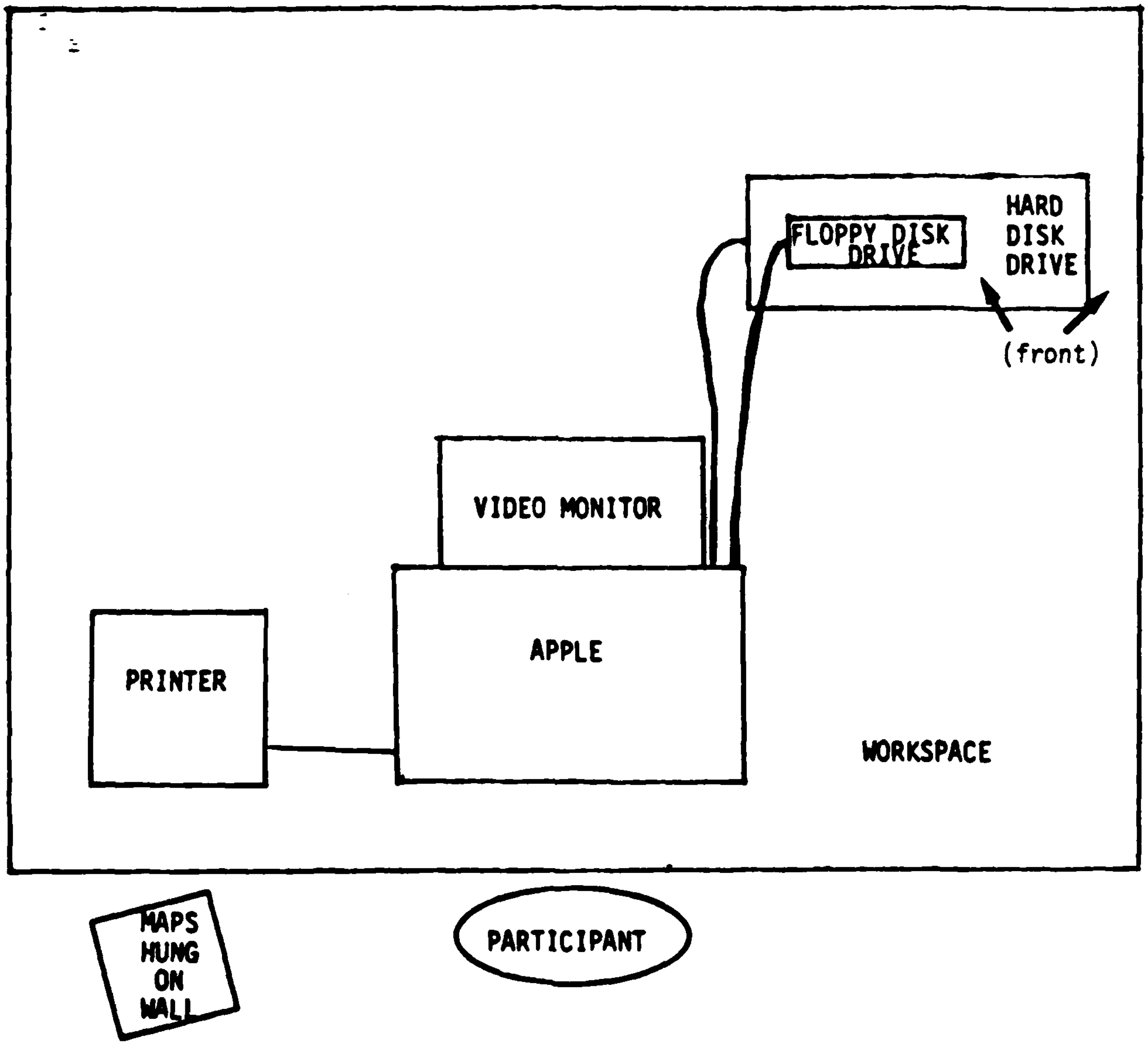

Figure 7. Recommended room arrangement. (From Criswell, Unger, Swezey, & Streufert, 1983c).

Software. Software for the simulation may be stored in the hard disk drive or on floppy disks. A list of the hundreds of files required and a description of the eight main simulation programs is presented in Unger and Swezey (1983).

Software for the simulation is composed of eight programs:

1. TEDITOR (APPLE WRITER)

2. TEDIT

3. LEDIT

4. DEDIT

5. AEDIT

6. VEDIT

7. SIM

8. PROFILE (formerly called MEASURE)

The TEDITOR (APPLE WRITER) program is a word processing program copyrighted by Apple Computer, Inc., which allows the user to type in and edit the messages that appear during the course of the simulation. The precise time during the simulation when a message occurs is determined by the TEDIT program. The decision alternatives selected by participants are created and edited by the DEDIT program. The LEDIT program contains the locations of movable and nonmovable objects in the scenario, and it also determines the scenario start time and time compression ratio. The AEDIT program generates messages in response to a participant's decisions. The VEDIT program keeps track of the location of all eight programs. The main simulation program, SIM, uses the output of the TEDITOR, TEDIT, LEDIT, DEDIT, AEDIT, and VEDIT programs to run the simulation. The PROFILE program is a data analysis program which calculates measures of participant performance. The measures are described in detail by Criswell, Swezey, and Streufert (1983a), Criswell et al. (1983c), and Unger and Swezey (1983).

Figure 8 shows the relationships among the eight programs. All programs are listed, annotated, and discussed by Unger and Swezey (1983).

All software was developed by Wise Owl Workshop of Livermore, California. All software was designed so that the scenario content (messages and response options) may be easily changed without changing the essential configuration of the software. In addition, the software was designed so that it would be easy to add additional software to enable the experimenter to respond directly to the participant during the simulation. This extra interactivity may be accomplished using computer game paddles; see Unger and Swezey (1983).

Other Materials. In addition to the hardware and software described above, other simulation materials include the Programmer's Manual (Unger & Swezey, 1983), Researcher's Manual (Criswell et al., 1983c), and Participant's Manual (Criswell, Unger, & Swezey, 1983b).

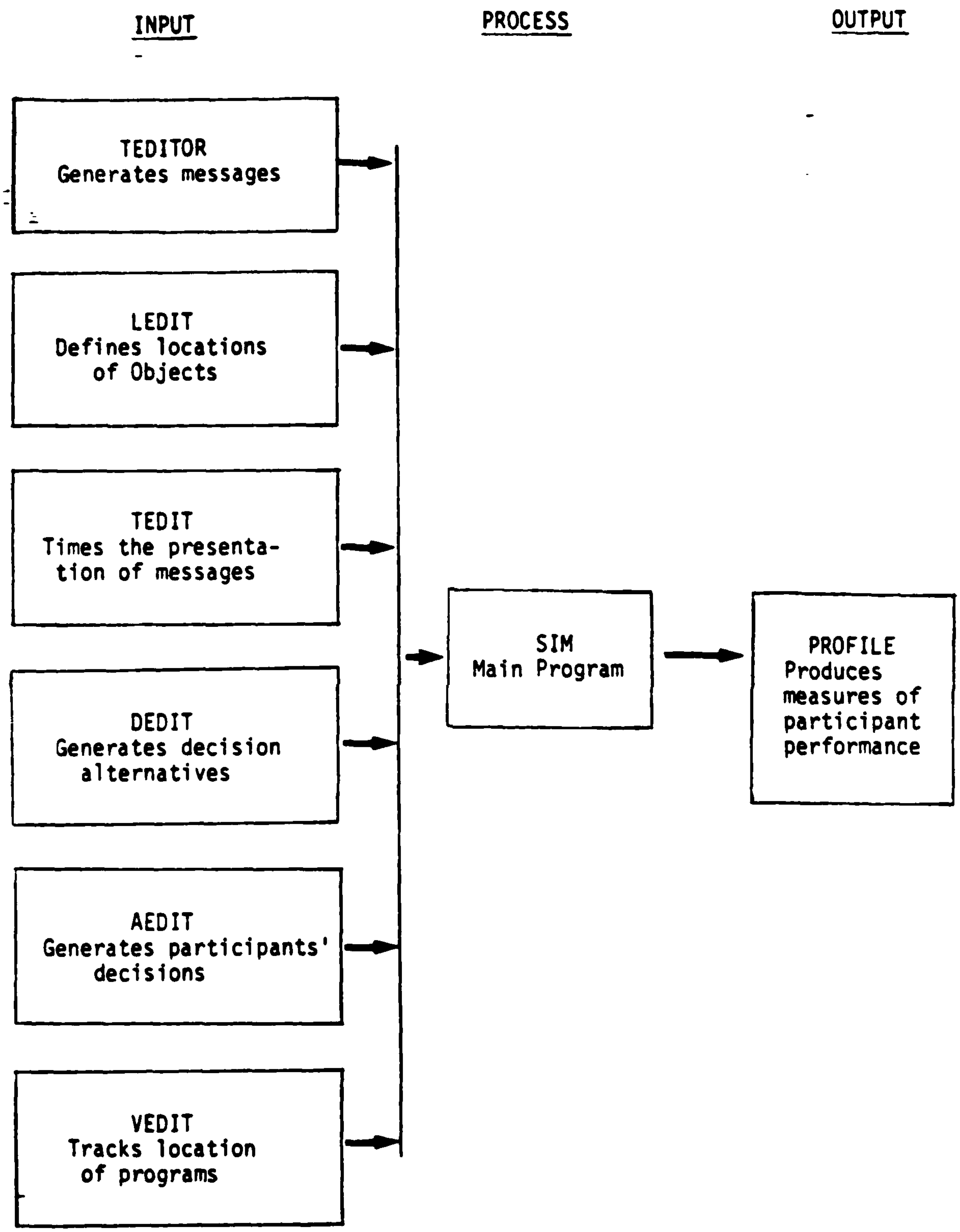

Figure 8. Eight programs in MATSS system software. (From Unger and Swezey, 1983).

The Programmer's Manual (Unger & Swezey, 1983) describes the hardware and software necessary to run the simulation, program component functions, and modification of the simulation, and participant response scoring.

The Researcher's Manual (Criswell et al., 1983c) explains the researcher's responsibilities in running participants through the simulation, describes the simulation materials, provides step-by-step simulation operating procedures, and presents instruction for interpreting subject profiles.

The Participant's Manual (Criswell et al., 1983b) provides detailed instruction about how the participant interacts with the computer during the simulation. This manual also presents historical and fictional military, political, and sociological information about Yugoslavia to set the stage for the Yugoslav Dilemma.

The choices of action available to the participant are termed "decision alternatives." Each scenario (i.e., the Yugoslav Dilemma and the practice session for that dilemma called "Storm") has its own set of decision alternatives. The Storm scenario has 32 choices of action. A participant may evacuate (22 choices) or request information about the situation (10 choices). Each decision alternative has its own unique code number which is entered into the computer. The Yugoslav Dilemma has 411 decision alternatives. The alternatives are divided into six action areas: economic (64 alternatives); political (106 alternatives); military (88 alternatives); covert operations (88 alternatives); public opinion (8 alternatives); and information request (57 alternatives). Decision alternatives are contained in the Participant's Manual (Criswell et al., 1983b) and the Researcher's Manual (Criswell et al., 1983c). Decision alternatives for the Yugoslav Dilemma are also available in a pamphlet with four two-sided pages.

The participant uses a special note-taking form to keep track of messages received and decisions made, and uses the form to make notes about strategy. Detailed instructions regarding its use are contained in the Participant's Manual (Criswell et al., 1983b).

Each scenario has its own scenario map with grid squares labelled by their x, y coordinates. The hand-drawn Storm scenario map has eight x-coordinates and nine y-coordinates. The Yugoslav Dilemma map is a color, commercially produced map of Eastern Europe on which a 32x45 grid has been printed. During the simulation, a participant may need to enter a location into the computer. The computer is programmed to accept x-, y-coordinates from only the scenario map. Other coordinates such as latitude-longitude coordinates from standard world maps are not accepted by the computer. For the Yugoslav Dilemma, a color, commercially produced map of Yugoslavia is also provided. This map shows the republics and major cities of Yugoslavia; however, this map may not be used for computer coordinates. These three maps are contained in the Participant's Manual (Criswell et al., 1983b).

Procedures. Figure 9 presents the sequence of activities in an experimental session of the Yugoslav Dilemma. All activities are fully described in Criswell et al. (1983b, 1983c). The entire sequence usually takes between six and eight hours, although this estimate varies depending on how much information a participant enters into the computer.

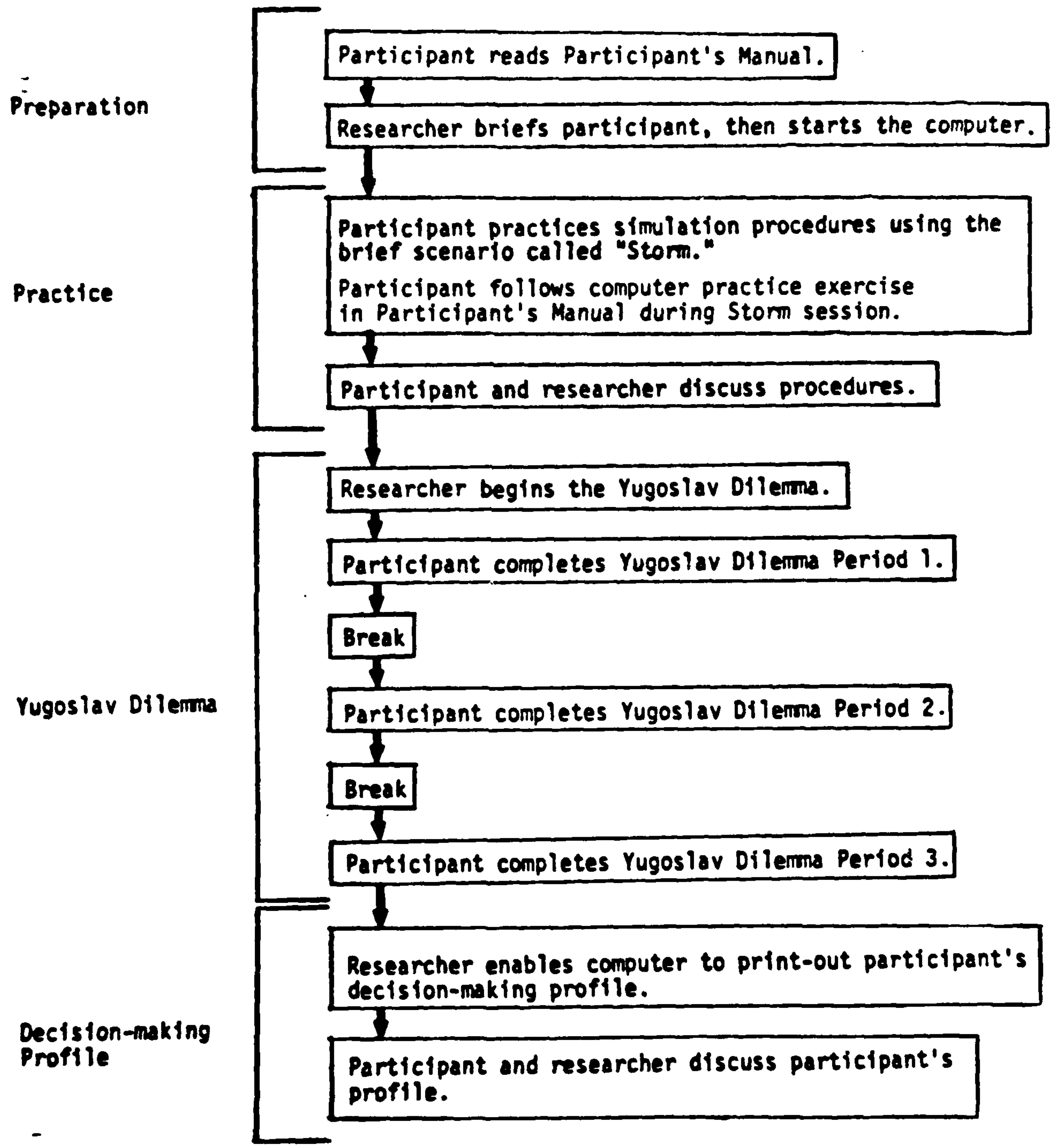

Figure 9. Yugoslav Dilemma activities. (From Criswell, Unger, & Swezey, 1983b).

As shown in Figure 9, the participant reads the Participant's Manual (Criswell et al., 1983b) before beginning the simulation, usually the day before. The participant then practices using the computer by engaging in a brief (nine minutes of simulation time, which takes approximately 20 minutes of real time) simulation called the "Storm" scenario. The computer collects data on participant action during this scenario, but it is not used for assessment purposes. The file is written over by data from the Yugoslav Dilemma (providing the same participant code name is used).

The participant then participates in the Yugoslav Dilemma using procedures outlined in the Participant's Manual (Criswell et al., 1983b). The main activities of the participant are to: (1) receive messages from the computer; (2) make notes and plans using the note-taking form; (3) enter decisions into the computer; (4) enter future decision plans into the computer, and (5) enter into the computer the decision and message numbers which relate to a present decision.

After the simulation, the researcher enables the computer to print out the participant's decision-making profile. The researcher then offers an interpretation of the profile according to information contained in the Researcher's Manual (Criswell et al., 1983c). The interpretation is tentative because the simulation has not been validated experimentally.

Manipulable Variables

The simulation contains four manipulable variables: information load, success/failure, fixed/responsive messages, and time compression. The relation of information load and success/failure with interactive complexity theory was described earlier in this report. The other two variables (fixed/responsive and time compression) are not related to interactive complexity theory.

Information Load. Information load refers to the number of messages presented to the participant per real time minute of elapsed simulation time. Information load is of great importance to complexity theory which proposes that perception and information processing are the result of an interaction between the individual information receiver and environmental complexity, or information load (Streufert & Streufert, 1978). The Yugoslav Dilemma was designed to create low, medium, and high levels of environmental complexity (one level or value of information load per simulation period), and to observe the receiver's responses. Those responses are used to make inferences about the receiver's information processing.

Presently, information load is fixed (not free to vary depending on a participant's responses), but load has different values in different parts of the simulation. During Periods 1, 2, and 3, ten messages (one message/three minutes of simulation time), five messages (one message/six minutes of simulation time), and 15 messages (one message/two minutes of simulation time), respectively, are delivered. Information load may be manipulated using the TEDIT program (see Unger & Swezey, 1983, for details).

Success and Failure. A success message is a response to a participant's decision that conveys that the action taken was successfully accomplished.

A failure message indicates the action was not successfully accomplished. The ratio of success to failure messages may be manipulated using the TEDIT program. TEDIT contains an agenda of messages listed by minute, by time into the simulation. This program can assign to each of those minutes in the simulation the presentation of a success ("Your decision was successful") or failure ("Your decision was not successful") message. The type of message appears irrespective of a participant's decisions. See Unger and Swezey (1983) for programming instructions.

Success and failure are pre-programmed in the present simulation. Each decision is keyed to a particular response (e.g., "Your decision to collect information from pro-Western nations concerning support for U.S. actions has had the following result: Support is growing."); some are successful and some are not. The success/failure ratio is consistent, but the amount of success and failure varies with the number of participant's decisions.

Responsive and Fixed Messages. A responsive message is one which specifically replies to a participant's decision. A fixed message is one which does not speak specifically to a participant's decision.

The program administers either a fixed or a responsive message every x minutes according to the schedule described above under Information Load. In the present simulation, a minimum 40% of the messages in each period are fixed messages; these messages (the same for every participant) keep the scenario unfolding. These fixed messages are programmed to occur at specific times, and responsive messages may not be delivered at those times.

At present, fixed messages must be presented during Period 1 at Minutes 0 (the start time), 12, 24, and 27; during Period 2 at Minutes 45 and 52; and during Period 3 at Minutes 64, 72, 74, 80, 82, and 90.

There are also message presentation times when a fixed message is not required; at these times, the program delivers a responsive message if one is due. The fixed message that might have been delivered at that time will never be delivered. However, if no responsive message is due, a fixed message will be delivered.

Changes in timing and ratio of fixed to responsive messages are made with the TEDIT program. See Unger and Swezey (1983) for details.

Time Compression. Manipulable variables in the Yugoslav Dilemma which concern time compression are ratio of simulation to scenario time, amount of scenario time advanced by each decision, length of session in scenario minutes, and scenario start time. This category of variables is not related to interactive complexity theory. However, these values may be modified; see Unger and Swezey (1983).

The "time" line found above each frame in the simulation looks like the sample in Figure 10.

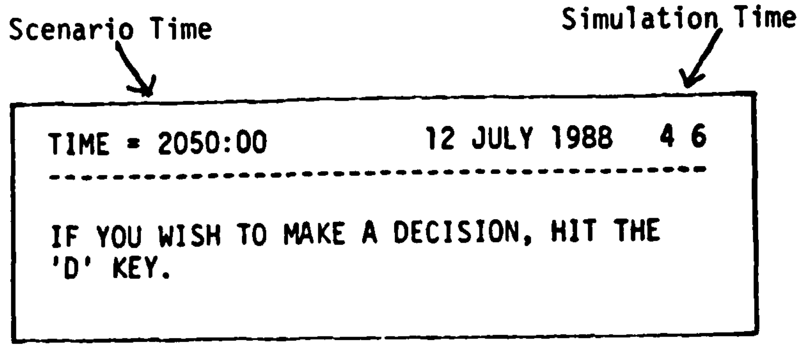

Figure 10. Scenario and simulation time line.

Scenario time of day is given in hours and minutes (seconds are always 00). In Figure 10, the time is 20 hours, 50 minutes, or 8:50 pm. Scenario time is programmed to progress one hour for every 30 seconds of simulation time. (Interruptions to this time progression are noted below.) Thus, in 30 seconds, the time in Figure 10 will be 2150:00.

The Storm scenario (used for practice in the MATSS) has one period of nine minutes of simulation time. Because simulation time does not progress during decisions, the real-time length of the session will vary depending on how long the participant spends making decisions and entering plans. If the participant makes no decisions, the Storm scenario will last nine minutes. (Session duration in real time is not measured by the computer. For that measure, a watch or other timepiece is needed.) In scenario time, however, 18 hours pass in the Storm scenario.

The Yugoslav Dilemma has three periods, each with 30 minutes of simulation time. Again, real time elapsed will vary depending on how long the participant spends making decisions and entering plans. If the participant makes no decisions, the scenario will last 90 minutes. In scenario time, two and one-half days will elapse in each period and there are seven and one-half days in the total scenario dilemma.

The ratio of simulation time to scenario time elapsed is set in the LEDIT program. Under the present program, the time multiplier is 120 which means that 120 scenario seconds pass for each second of simulation, or one hour for every 30 seconds of simulation time. This ratio may be changed; see Unger and Swezey (1983).

Minute markers may be displayed on the time line. If displayed, they are the right-most digits on the time line. In Figure 10, the minute markers are 4 and 6. The first digit, in this case the 4, counts real minutes of elapsed simulation time. In Figure 10, the 4 means that this simulation has been progressing a total of 4 minutes. The value of this minute marker may not be changed.

The second digit (in Figure 10, the second digit is the 6) displays the real time minute of elapsed simulation time at which the next message will be delivered. In the sample in Figure 10, the next message will be delivered at Minute 6, and the simulation is now in Minute 4. When both digits register 6, the message is displayed, then the second digit advances to the time of the

next message. The second digit changes as a function of the values set in TEDIT for timing of message delivery; see Unger and Swezey (1983) for use of TEDIT.

When the participant makes a decision, the simulation clock stops. The clock remains stopped until:

- o The decision is entered.
- o Any future planned decisions are entered.
- o Any previous decisions made while current action was planned are entered.
- o Any previous messages which lead to current action are entered.

When the participant reenters the scenario, the scenario clock progresses one hour. This value may be changed using the LEDIT program. See Unger and Swezey (1983).

Because simulation time stops during decision times, total length of session in real time cannot be predicted. Real-time session duration depends on the time the participant spends making decisions and entering plans. The length of scenario time in each session, however, may be modified using the TEDIT program; see Unger and Swezey (1983).

LEDIT also stores the day, month, and year of the beginning of each scenario. The date progresses with scenario time and is displayed on the right side of the time line. Scenario start date and time may be modified; see Unger and Swezey (1983).

Measures of Decision Making

Nine of the fourteen (14) measures of decision making in the simulation relate specifically to predictions based on interactive complexity theory. These measures are briefly described below. For detailed explanations of all measures, see Appendix A or Criswell et al. (1983c).

General unintegrated decisions are decisions which are not part of integrations. Decisions of this nature reflect a lack of overall planning. They are not made in response to incoming information and often represent trial and error actions. For unidimensional persons, general unintegrated decisions may occur at all levels of environmental complexity. Multidimensional persons, especially integrators, would not score many general unintegrated decisions in a situation like the Yugoslav Dilemma which suggests strategic planning. An excessive number of unintegrated decisions may be expected on the Yugoslav Dilemma from unidimensional persons.

Respondent (or one-to-one) decisions are made in direct, and usually immediate, response to incoming information. Some respondent decision making is evident in the behavior of all complexity groups. However, respondent

decisions are particularly prevalent in decision sequences generated by unidimensional persons. Persons who can neither differentiate nor integrate tend to depend on the environment for cues upon which they can base their actions. At high information load levels, respondent decisions by unidimensional persons may be substantially increased in number and often reach or exceed 50% of their total decisions. This is because the person may react separately to each bit of information.

Proportion of unintegrated respondent to respondent decisions supplements the measure of unintegrated respondent decisions. This ratio reflects integrative strategy. As the proportion nears 1.0, less integrative strategy is implied. Thus, scores near 1.0 would be expected from unidimensional participants.

Backward integrations indicate that a relationship between decisions was seen by the participant, but only in retrospect. Backward integrations reflect less strategic planning than forward integrations, but nevertheless reflect some strategy. Thus, they occur with greater frequency for multidimensional than for unidimensional participants.

Forward integrations, indicating prospective strategic planning, is the basic measure of decision integration. Unidimensional persons should generate very low scores, differentiators should generate low scores, and integrators should generate moderate to very high scores in this measure.

Multiplexity F means multiple complex strategies in a forward direction. This measure counts all connected integrations forward of each integration until the end of the simulation. As any one course of action leads to increasing numbers of decision points, multiplexity F scores increase. This type of planning is characteristic of multidimensional, not unidimensional, planners.

Within multidimensional planners, differentiators will score only low or moderately high on this measure. Low-level integrators score moderately high, and high-level integrators attain high scores.

The weight measure indicates the length of time across which persons integrate. The lowest weight scores would be scored by unidimensional planners who do not integrate. Differentiators may produce weight scores slightly higher than those for unidimensional persons, but differentiators' scores would remain near the lower end of the distribution for this measure. Low-level integrators should generate moderate weight scores and considerably greater weight scores should be generated by high-level integrators.

Quality of integrated strategies (QIS) relates to the interweaving of any one forward integration into other integrations. For each forward integration, QIS adds the number of forward integrations directly connected to the beginning and end points of the forward integration and multiplies this sum by the time weight. Thus, QIS increases as individual integrations become woven into other integrations. QIS is low for unidimensional persons and differentiators. QIS is slightly higher for low-level integrators than for differentiators and may reach very high levels for high-level integrators.

Weighted QIS considers all connected integrations in the entire simulation. For each forward integration, weighted QIS (like QIS) adds up all forward integrations connected to the beginning and end points of the forward integration, but (unlike QIS) weighted QIS also includes all forward integrations linked to those integrations tracing them all the way to the beginning and end of the simulation. Thus, this measure increases with high levels of strategic planning and lengthy sequences of decisions toward more distant goals. Lengthy sessions are required in order to generate high scores on this measure. The highest scores (some scores obtained in the thousands) on this measure will be generated by high-level integrators. Scores for low-level integrators should remain moderately low, and scores achieved by all other groups should remain near zero.

Measures on Participant's Profile. Many measures related to decision making have been devised. Only the measures related to interactive complexity were described above. However, the participant profile contains other measures related to decision making (but not theoretically linked to complexity theory) in addition to data regarding each decision executed (see Appendix A).

A sample participant profile is provided in Appendix B so the reader can get an idea of the range of complexity measures and decision data contained in a profile. Criswell et al. (1983c) present a full interpretation of the entire profile. As a brief example, a summary portion of the printout in Appendix B is described below.

Sample	Explanation
PERIOD 1	Period number
1-MEASURE=15 (# OF DECISIONS)	Number of decisions
2-MEASURE=5 33% (# OF RESPONDENT DEC.)	Number of respondent decisions, and percent of total decisions
3-MEASURE=10 (# OF DEC. CATEGORIES)	Number of decision categories used
4-MEASURE=13 86% (# OF FWD INTEGRATIONS)	Number of forward integrations
5-MEASURE=133 886% (MULTIPLEXITY F)	Multiplexity F
6-MEASURE=116 MINUTES (WEIGHT)	Weight factor in minutes of simulation time
7-MEASURE=0 0% (# OF BKD INTEG)	Number of backward integrations
8-MEASURE=2 13% (# OF UNINTEG. RES.DEC.)	Number of unintegrated respondent decisions
9-MEASURE=562 (QIS)	QIS (Quality of integration strategies)
10-MEASURE=2052 (WEIGHTED QIS)	Weighted QIS
11-MEASURE=2.9 (AVE. RESPONSE SPEED)	Average response speed in seconds of simulation time
12-MEASURE=4 (SERIAL CONNECTIONS)	Number of serial (very similar) decision connections
13-MEASURE=1 (PLANNED INTEGRATIONS)	Number of integrations planned but not executed
14-MEASURE=4 (GENERAL UNINTEGRATED DEC.)	Number of general unintegrated decisions

Example Profiles

Defining categories of cognitive complexity against which to estimate the validity of categories predicted by scores on the Yugoslav Dilemma simulation requires the use of a selection instrument other than the Yugoslav Dilemma simulation. Such comparisons have been made for a small group of participants in the Yugoslav Dilemma. The Sentence Completion Test (Schroder, Driver, & Streufert, 1967; Schroder & Streufert, 1962) was selected as the comparison test because it classifies persons across the entire dimensional range, and because it has been used for classification purposes in many other studies (c.f., Kennedy, 1971; Stager, 1967; Streufert, 1970; Streufert & Schroder, 1965; Streufert, Streufert, & Castore, 1969; Turney, 1970).

As described earlier, interactive complexity theory predicts nine categories of decision makers based on the concepts of differentiation and integration. However, the most recent work on the Yugoslav Dilemma concentrated only on unidimensional, multidimensional differentiative, and integrative categories for two reasons. First the measures used in the Yugoslav Dilemma simulation were not developed on the basis of fine distinctions, and second, the existing data base, which provides at least partial support for some of the measures included in the Yugoslav Dilemma, is much too small to permit testing for more extensive individual differences in structural information processing.

Thus, three basic categories are of interest. Participants may be described as unidimensional, as multidimensional differentiators, or as multidimensional integrators. Unidimensional persons are expected to engage in very little differentiation and no (or very little) integration, and should display only limited strategic capacity. Multidimensional differentiators are expected to generate a number of cognitive dimensions, but should not be able to integrate these dimensions or show only minimal integration. Multidimensional integrators are expected to generate a number of dimensions and to relate these dimensions to a more overall strategy as an aid to their decision-making efforts.

An additional distinction is made between multidimensional low-level integrators and multidimensional high-level integrators. A low-level integrator is expected to relate differentiated dimensions in terms of a conceptualization, strategy, or goal which is relatively short-term and not necessarily meaningful for other strategies or goals. In contrast, the multidimensional high-level integrator is expected to generate quite complex strategies which are interrelated over time and interconnected at higher strategic levels.

Seven participants were administered the Sentence Completion Test. Scores on the test range from one to seven, persons who score one to two, three to four, five, and six to seven are classified as unidimensional, multidimensional differentiators, multidimensional low-level integrators, and multidimensional high-level integrators, respectively. This sample of seven participants consisted of two unidimensional persons, two multidimensional differentiators, two multidimensional low-level integrators, and one multidimensional high-level integrator.

The seven participants each completed the Yugoslav Dilemma simulation. Next, simulation measures of decision-making style were examined to determine if scores were similar within categories of participant assigned by the Sentence Completion Test. If the scores were similar only within, but not across categories, then the Yugoslav Dilemma measures could be said to differentially predict categories of decision makers.

All participants received scores on the simulation for the nine measures of decision making (described earlier) related to complexity theory. A per-period mean was calculated for each measure for each participant. (See Criswell et al., 1983c, for details on calculations of the nine measures.)

A graph was then constructed which includes a scale for each of the score ranges obtained on each measure. The scales for the nine measures are the same length, but number values on the scales are different. Scales are laid out such that scores predicted for unidimensional persons fall toward the top of the figure; for multidimensional persons, about the middle of the figure; and scores for integrators should tend toward the bottom of the figure. These are general trends identified only for purposes of graph construction.

Figure 11 presents the scores obtained by the two participants classified by the SCT as unidimensional. The scores for both participants tend near the top of the figure with the exceptions of general unintegrated decisions, respondent decisions, and backward integrations for the participant scoring two on the SCT. The scores are orderly in the sense that the participant scoring one on the SCT appears more unidimensional on the simulation than the participant scoring two on the SCT.

Figure 12 presents the scores obtained by the two participants classified by the SCT as multidimensional differentiators. The scores for both participants fall generally in the expected direction. The scores are orderly in the sense that the participant scoring three on the SCT appears to be more of a differentiator on the simulation than the participant scoring four on the SCT.

Figure 13 presents the scores obtained by the three participants classified by the SCT as multidimensional integrators. The scores for these participants fall generally in the expected direction. The scores are orderly in the sense that the participant scoring seven on the SCT appears more integrative on the simulation than the participants scoring five on the SCT. The very high-level integrator, as identified by the SCT (score = 7), was also a very high-level integrator on the Yugoslav Dilemma.

Figure 14 presents the mean scores obtained for each of the three small groups of participants. All group scores fall in the expected relation to each other. In addition, although considerable overlap across some individual scores was seen, there is overlap across group mean scores only on one measure (backward integrations). The data presented in Figures 11 through 14 suggest that the Yugoslav Dilemma measures identify broad classes of decision makers as might be predicted from interactive complexity theory.

It is striking from Figure 14 how closely the unidimensional and multidimensional differentiator groups score on measures related to integrations

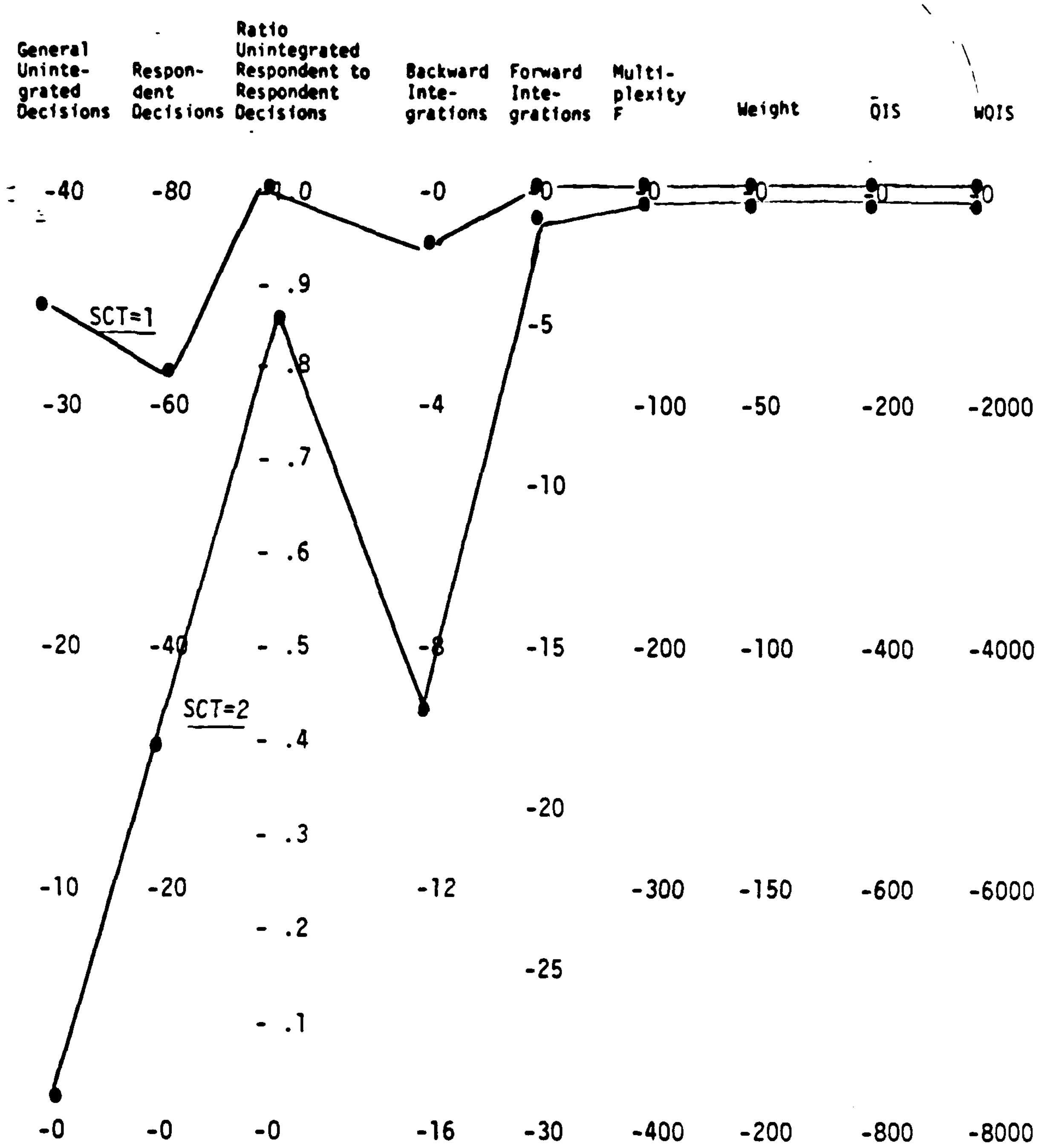

Figure 11. Scores obtained on the Yugoslav Dilemma by two unidimensional participants (SCT=1, SCT=2).

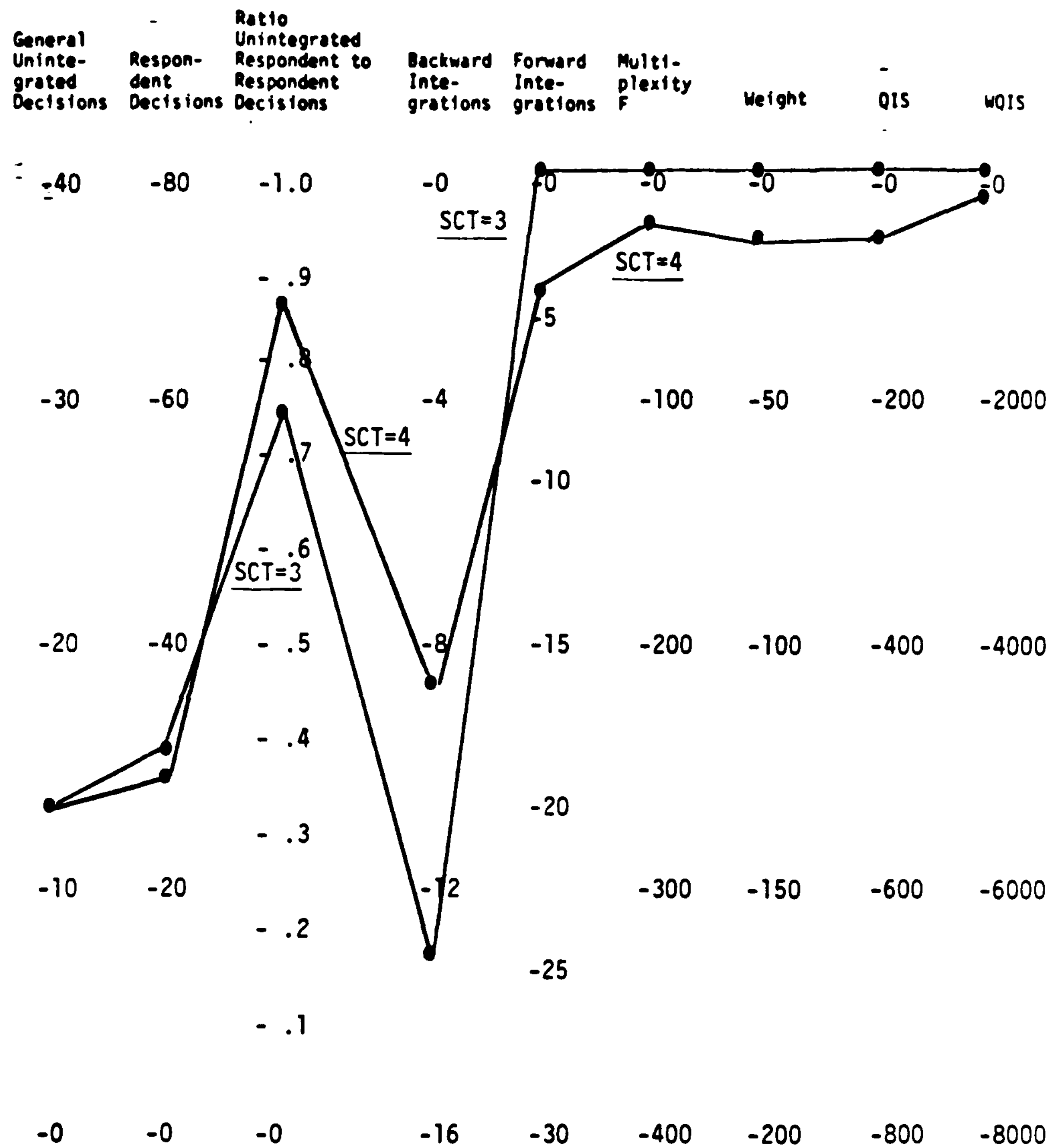

Figure 12. Scores obtained on the Yugoslav Dilemma by two multidimensional differentiators (SCT=3, SCT=4).

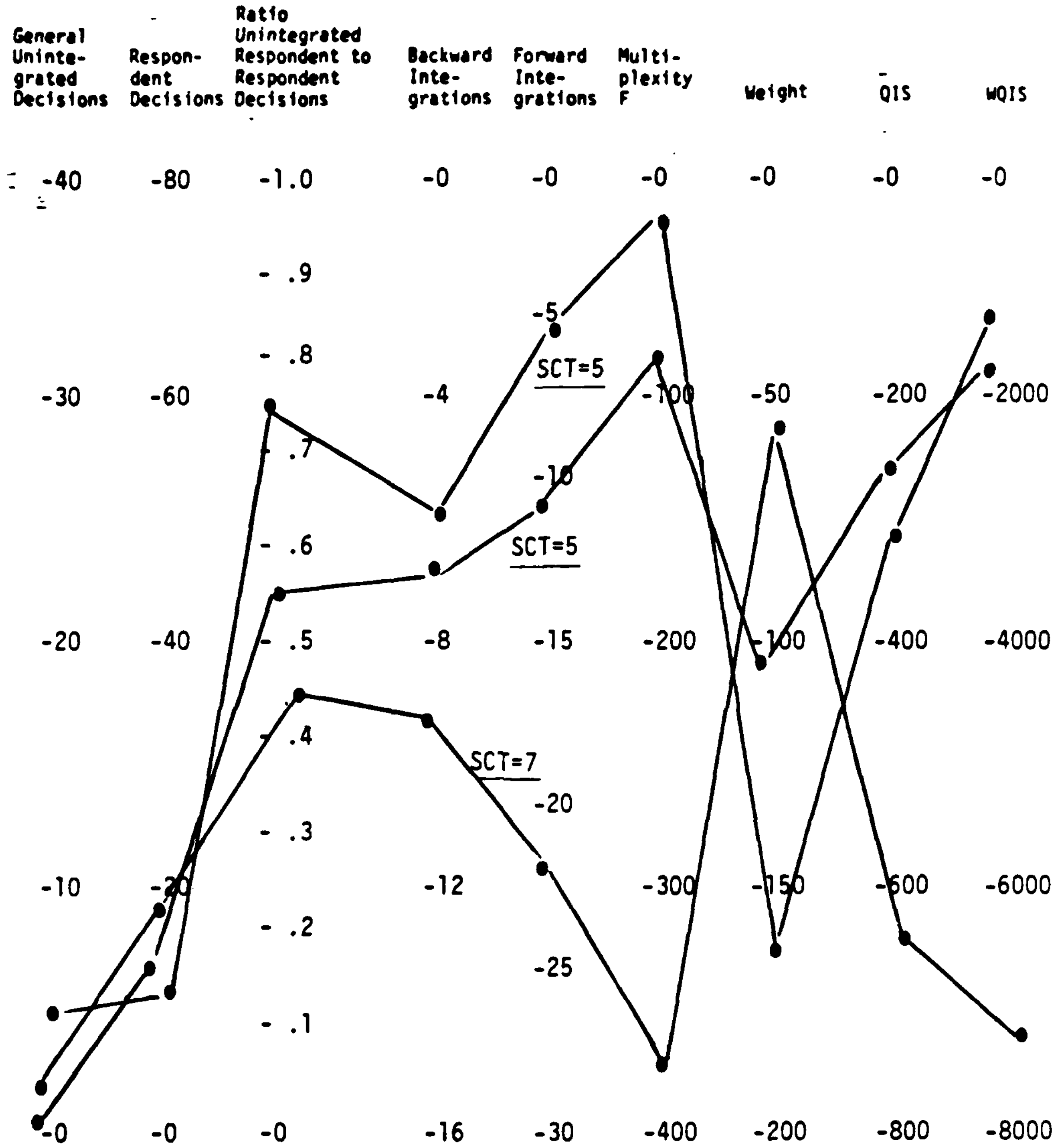

Figure 13. Scores obtained on the Yugoslav Dilemma by three multidimensional integrators (SCT=5, SCT=5, SCT=7).

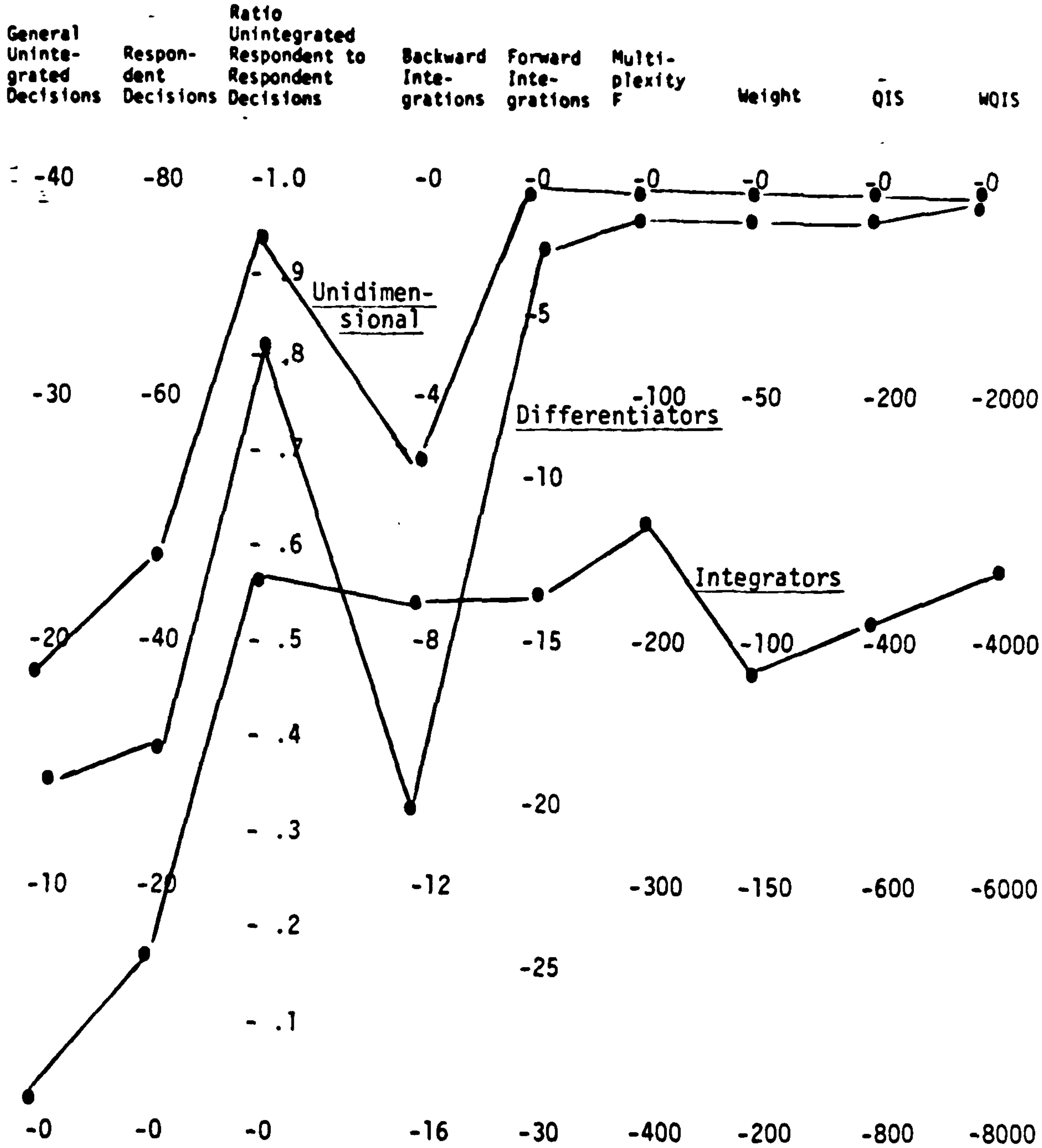

Figure 14. Group mean scores obtained on the Yugoslav Dilemma by unidimensional, multidimensional differentiative, and multidimensional integrative participants.

(i.e., forward integrations, multiplexity F, weight, QIS, and WQIS. The scores are all low as predicted; one factor, however, that may explain some of the suppression on the measures is computer procedures. In some ways, the present procedures by which a participant interacts with the simulation are unwieldy, and this unwieldiness may prevent full participation. For example, to enter a decision, a participant must enter its four- or five-digit code number one digit at a time, with a different, wordy screen prompt displayed between each digit. It would be preferable if the participant could simply enter the decision number and then press RETURN.

The problem with entering decision codes carries over to reporting future decision plans, an activity which is critical to the identification of integrations in decision-making structure. Presently, the code number for each planned decision must be entered one digit at a time, as mentioned above. This slow entry process may prevent participants from entering plans. Thus, we may be artifically restricting the scoring of integrations.

The data presented in Figures 11 through 14 are not norms in any sense. These data are offered only as samples of decision makers in the Yugoslav Dilemma which appear to represent the three broad classes of decision makers.

RECOMMENDATIONS FOR FUTURE USES OF THE MANAGEMENT ASSESSMENT AND TRAINING SIMULATION SYSTEM (MATSS)

The future of the MATSS appears to center around three activities: establishing the validity of the MATSS, modifying its content for different applications, and then employing it in training and organizational modification. Establishing three major types of validity is of concern: content, construct, and criterion-related. This activity must precede the establishment of norms to assist in the interpretation of the cognitive style profiles.

The content validity of the MATSS has been a primary concern of this project. Establishing the content validity of the MATSS has two aspects: determining that the Yugoslav Dilemma scenario adequately represents a situation in which complex decision making is required, and determining that the decision options, messages, and feedback are realistic. Determinations of this sort are made by subject matter experts. First, the scenario appears to represent adequately a complex decision-making situation. It parallels other complex decision-making situations and has been found to produce an environment conducive to multidimensional planning. Second, the realism of the simulation was built into the simulation even before it was acquired from the Army War College, and it has since been significantly expanded and updated by military and Eastern European experts. In addition, as more and more participants go through the simulation, the decision files can be continually upgraded to permit an even wider range of realistic decision options.

The construct validity of the MATSS refers to how well the simulation measures what it was designed to measure, i.e., cognitive complexity. Although the MATSS was specifically designed to measure cognitive complexity, research needs to demonstrate this empirically. This process involves showing how the MATSS relates to other measures of cognitive complexity and/or decision making. Construct validity will be established if the MATSS

correlates positively with other measures to which it should theoretically relate (convergent validity) and correlates negatively with measures from which it should theoretically differ (discriminant validity). This process will be a large and major effort. The data gathered from the seven profiles was a first step in this direction. The results of the construct validation will be a description of what the MATSS actually measures in relationship to other measures whose validity has already been established. Before the MATSS is used for any purpose other than research, its construct validity should be established.

Although the criterion-related validity of the MATSS has not been a primary concern of this effort, it is an important area for future research. Criterion-related validity refers to how well performance on the MATSS can predict a participant's behavior in other decision-making settings. This would involve making naturalistic observations and other measurements of MATSS participants to determine if they make decisions in other settings the same way they make decisions in the Yugoslav Dilemma. Such research will help determine what cognitive styles are desirable and in what situational contexts. Answers to these questions will be a major prerequisite to the development of any training procedures using the simulation. This information will be indirectly available through the construct validation work which will have related the MATSS to the existing criterion measures in other complexity studies.

Content concern may open an avenue of exploration in the future of the MATSS. Although the MATSS presently contains a specific political-military scenario, there are no restrictions on the content which may be used in the scenario because the measures of cognitive complexity are insensitive to the content of the decisions. Consequently, just as the content of the Storm practice scenario is different from the Yugoslav Dilemma scenario, so other scenarios can be developed easily. This flexibility to construct specific scenarios for each setting of interest is one of the strong points of the MATSS.

Although the MATSS is designed to be a measure of "how" people think and not "what" they think, it may be desirable also to develop some scoring procedures that are sensitive to the content of the decisions. These procedures would need to be developed by subject matter experts in the content area of the simulation. For example, in the Yugoslav Dilemma, there are no doubt certain decisions or decision types that are more appropriate to make than others in response to the events of the simulation.

Finally, the MATSS may be used in training and organizational modification. As described in Streufert (1982), the MATSS may become a valuable aid in several endeavors. One, it may be useful in training personnel how to employ a multidimensional decision-making style and teach them when to apply the style for best results. Two, it may help place people who typically employ a certain style into positions where that style has special usefulness. Three, using the MATSS, it may be possible to teach people how to regulate their own information load in order to minimize the likelihood of underload or overload. Fourth, the MATSS may help people better understand their own cognitive styles and to more appropriately adapt their styles to the requirements of the situation. Finally, the MATSS may be useful in helping design environments which foster the multidimensional strategies which will be most useful for the particular information processing task at hand.

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APPENDIX A

DETAILED EXPLANATIONS OF THE 14 MEASURES OF DECISION MAKING

The purpose of this appendix is to provide complete definitions of the 14 measures of decision-making strategy calculated by the computer for each simulation period. This appendix provides more detail than that given in the body of the report; it explains the calculation of measures on the "Complex Test" sample participant. That profile is presented in Appendix F.

The 14 measures are calculated by the computer using the data stored for each decision. These data are printed out if the data list option is selected. The majority of the Complex Test printout in Appendix F is the data list section. Pertinent data from the data list section appear in Table A.

Using the data in Table A, a diagram called a time-event matrix was constructed and is presented in Figure A. This matrix contains a point for each decision and clearly shows decision connections. The horizontal axis is time, the vertical axis is decision category. Forward integrations are noted by diagonal lines with a forward arrow ➡ , backward integrations are diagonals with a backward arrow ⬅ , serial connections are horizontal lines with a forward arrow ➡ . The sample calculations in the the appendix will refer to Table A and Figure A.

Number of decisions (Measure 1) is the total number of decisions executed within a simulation period. To score a decision, a participant must:

Enter the decision code.

Execute the decision (by pressing RETURN When the computer asks if the decision should be executed)

Every decision is counted even if the same decision is executed more than once.

As shown in Table A and Figure A, 15 decisions were executed during period 1, 16 in period 2, and 7 in period 3. The category numbers of the decisions are also available in Table A and Figure A.

TABLE A

DATA FOR SAMPLE PARTICIPANT "COMPLEX TEST"
(Adapted from Unger and Swezey, 1983)

DECISION #	DECISION CATEGORY	BASED ON MESSAGE	PLANNED DECISIONS	BASED ON DECISION #	TIME DECISION EXECUTED
PERIOD 1:					
1	111	1	1121	-	.5
2	112	1	3211, 3212	1	2.5
3	321	-	1211, 3221, 3222	2	4.5
4	121	-	3221, 3222	3	6.5
5	122	-	3221, 3222	-	8.5
6	112	-	-	-	10.5
7	322	-	3211, 3212, 3221, 3222, 1311, 2121, 2122	3, 4, 5	12.5
8	322	5	3221, 3222	7	14.5
9	131	5	1311, 1331	7	16.5
10	212	-	1331, 2211, 2212	7	18.5
11	322	-	3211, 3212	8	20.5
12	131	-	-	9	22.5
13	132	-	-	-	24.5
14	232	-	2321, 3111	-	26.5
15	111	9	-	-	28.5
PERIOD 2:					
16	321	-	1211	7, 11	30.5
17	133	-	1211	9, 10	32.5
18	211	-	-	-	34.5
19	112	-	1211	-	36.5
20	213	-	1321	-	38.5
21	221	-	1321	-	40.5
22	222	-	1321	-	42.5
23	122	13	-	15, 18	44.5
24	231	14	-	-	46.5
25	211	14	-	-	48.5
26	311	-	3221, 3222	14	50.5
27	121	-	3221, 3222	16, 17, 19	52.5
28	111	-	3221, 3222	-	54.5
29	132	-	3221, 3222	20, 21, 22	56.5
30	232	-	3221, 3222	14	58.5
31	111	-	3221, 3222	-	60.5
PERIOD 3:					
32	211	18	-	-	62.5
33	411	19	2231, 2232	-	64.5
34	112	-	1221	-	66.5
35	322	-	1211, 1331, 2231, 2232	26, 27, 28, 29, 30, 31	68.5
36	121	-	1111	35	70.5
37	133	-	1111	3	72.5
38	223	-	-	33, 35	74.5

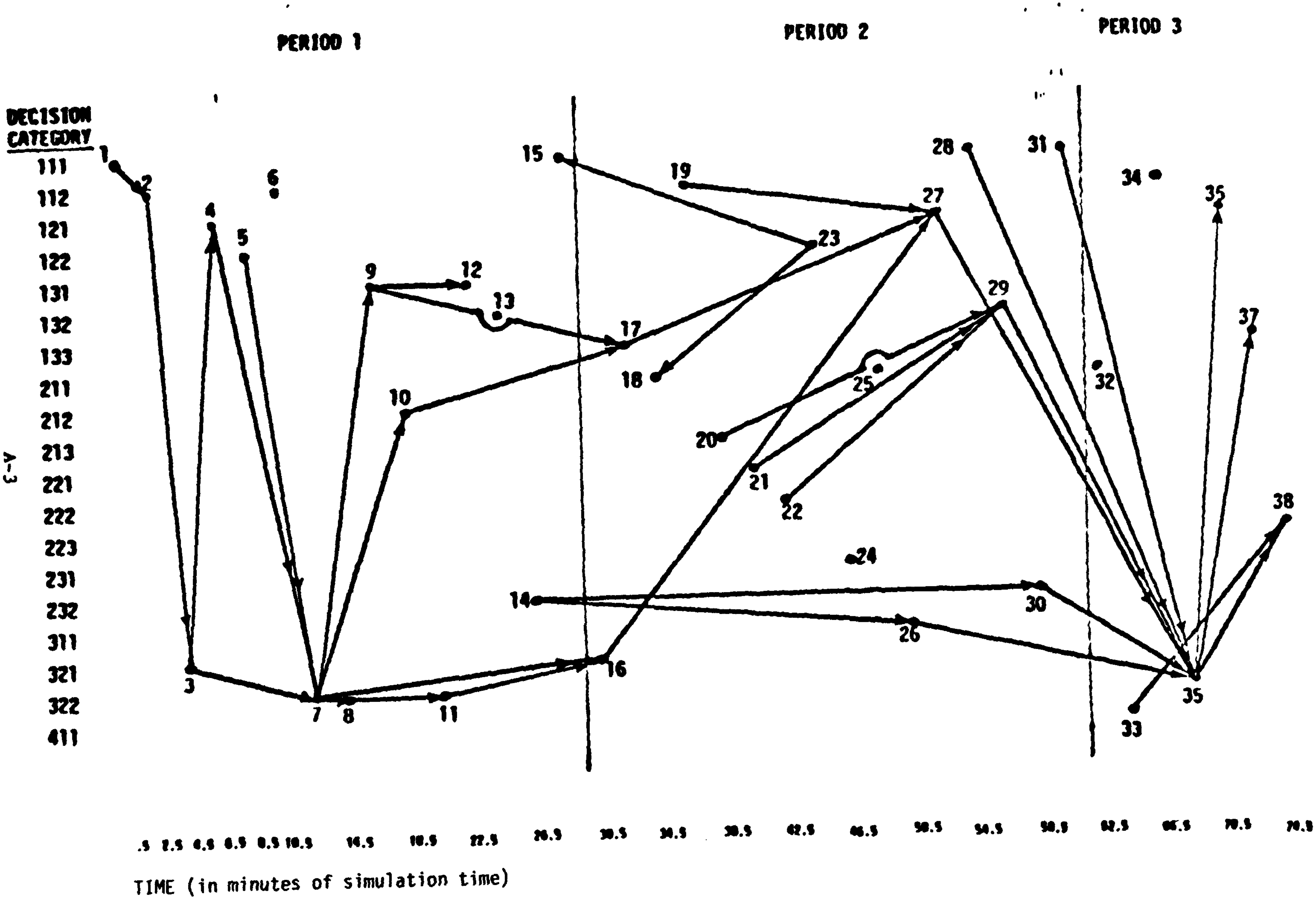


Figure A. Time-event matrix for sample participant "Complex Test" (adapted from Unger and Swezey, 1983).

Number of respondent decisions (Measure 2) is the total number of decisions executed within a simulation period based on a previous message. To score a respondent decision, a participant must:

- Execute a decision
- Report that the decision was based on a previous message or messages

If one decision was based on two messages, then two respondent decisions are scored for that one decision, and so forth. Thus, the number of respondent decisions may exceed the total number of decisions.

From Table A, we see that five respondent decisions were executed in period 1 (with category numbers 111, 112, 322, 131, and 111). We calculate this by counting the number of decisions reported to be based on a message, counting each decision once for as many messages on which it is based. Table A shows three respondent decisions in period 2, and two in period 3.

Also for Measure 2, the printout gives the proportion of respondent to total decisions; in this case, 5/15 or 33% for period 1, 3/16 or 18% for period 2, and 2/7 or 28% for period 3.

Number of decision categories (Measure 3) is the total number of decision categories used within a simulation period. As described thoroughly in the body of the report, a decision category is the first three digits of a decision code, or a decision choice sequence through the first three choice options. Decisions coded 1211 and 1213 are in the same category (121), but decisions coded 1211 and 1221 are in different categories. The decision category of each executed decision is scored only once no matter how often it is selected within a period.

From Table A, we see the decision categories selected in order in period 1 are: 111, 112, 321, 121, 122, 112 (already selected), 322, 322 (already selected), 131, 212, 322 (already selected), 131 (already selected), 132, 232, and 111 (already selected) for a total of 10 categories used in period 1.

The 14 categories in period 2 are scored for each decision except decision numbers 25 and 31 whose categories were already scored.

Each decision in period 3 fell in a different category for a total of seven.

Number of forward integrations (Measure 4) is the total number of forward integrations originating within a period. The integrations may be completed within the period of origination or in a later period. To score a forward integration, a participant must:

- Execute a decision
- Plan a future decision in another decision category
- Execute the planned decision (or any decision in the same category as the planned decision)
- Report that the planned decision was based on the previous decision

To calculate number of forward integrations from Table A, we start at decision 1, code 111. At the time of execution, decision 112 (in a different category from 111) was planned. Later, at decision 2, 112 was executed, and the participant reported that decision 112 was based on previous decision 1 (which is decision 111). Thus, the forward integration is complete.

From Table A, we count the following forward integrations: decision 1 to 2, 2 to 3, 3 to 4, 3 to 7, 4 to 7, 5 to 7 (7 to 8 does not count because both are in the same category), 7 to 9, 7 to 10, 7 to 16, (8 to 11 does not count because they are in the same category; 9 to 12 is also within a category), 9 to 17, 10 to 17, 11 to 16, and 14 to 26 (14 to 30 is within a category).

It is easy to count forward integrations from Figure A. Simply count the diagonals with a forward arrow. (Horizontal lines do not count because they connect within category decisions). Using Figure A, the 12 forward integrations in period 2 are 17 to 27, 16 to 27, 19 to 27, 20 to 29,

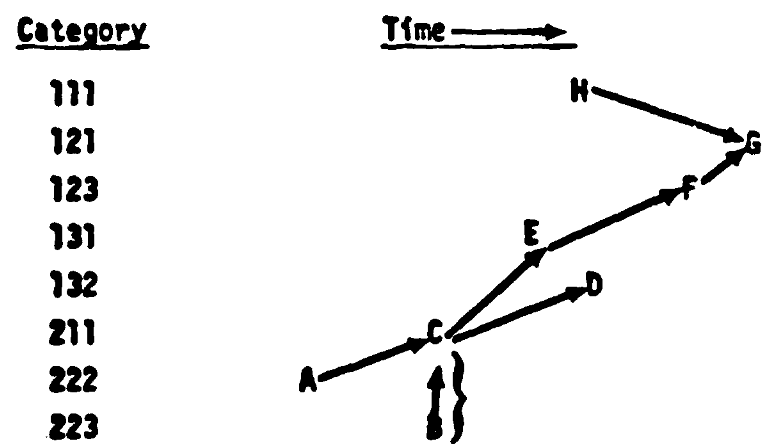
21 to 29, 22 to 29, 26 to 35, 30 to 35, 27 to 35, 29 to 35, 28 to 35, and 31 to 35. In period 3, the four forward integrations are 35 to 36, 35 to 37, 35 to 38, and 33 to 38.

Also for this measure, the printout includes the proportion of forward integrations to total decisions. For period 1, this ratio is 13/15 or 86%; for period 2, 12/16 or 75%; for period 3, 4/7 or 57%.

<u>Multiplexity F (Measure 5)</u> is the sum of the count of each forward integration scored within a period, plus all forward integrations originating and ending in the endpoint of each forward integration, plus all forward integrations originating (not ending) in the endpoint of subsequent, directly connected integrations leading to the end of the simulation.

Multiplexity F reflects future planning. As any one integration leads to other integrations, multiplexity increases. Three sample calculations follow.

The sample below appeared in the body of the report and is repeated here for reader convenience. The sample below diagrams seven connected forward integrations (indicated by the arrow at the end of the diagonals). For example, decision C was planned at decisions A and B, and when C was executed, it was reported based on A and B.



We will use this diagram to explain the calculation of Multiplexity F for integration BC.

$$BC+AC+CD+CE+EF+FG = 6$$

HG does not count because it ends, not begins, at the endpoint of the forward integration FG, which is not the integration of interest. AC counts because, for the integration of interest, BC, all integrations connected to its endpoint are connected. If all seven integrations were scored in one period, the total for the period would be the sum of the values for each integration.

To calculate Multiplexity F for period 3 in the sample, refer to the time event matrix (Figure A) and to Table B.

Period 2 of the sample provides a more complex example. See Table C.

Weight or integration time weight (Measure 6) is the sum of the time elapsed from initial to endpoint decision for each forward integration scored in a period. Time in this measure is minutes of simulation time. For example, if time from original decision A to planned and executed endpoint decision C is three minutes, and from decision B to planned decision D is five minutes, the weight is eight minutes (even if AC and BD overlap in time). Backward integrations (see Measure 7) are not counted in this measure.

Weight may be easily calculated using the data in Table A. For period 1, weight for the 13 forward integrations credited to period 1 is calculated in Table D.

Number of backward integrations (Measure 7) is the total number of backward integrations originating in a period. The backward integration may or may not end in the same period. To score a backward integration, the participant must:

- Enter a decision A (endpoint decision)
- Not enter plans to execute decision B

TABLE B

MULTIPLEXITY F CALCULATION FOR PERIOD 3 FOR SAMPLE PARTICIPANT "COMPLEX TEST"

FORWARD INTEGRATIONS SCORED IN PERIOD 3	ALL FORWARD INTEGRATIONS DIRECTLY CONNECTED TO THE ENDPOINT	FORWARD INTEGRATIONS ORIGINATING AT THE ENDPOINT OF SUBSEQUENT CONNECTED INTEGRATIONS	CALCULATIONS
35-36	-	-	1
35-37	-	-	1
35-38	33-38	-	2
33-38	35-38	-	2
		TOTAL =	6

TABLE C

MULTIPLEXITY F CALCULATION FOR PERIOD 2 FOR SAMPLE PARTICIPANT "COMPLEX TEST"

FORWARD INTEGRATIONS SCORED IN PERIOD 2	ALL FORWARD INTEGRATIONS DIRECTLY CONNECTED TO THE ENDPOINT	FORWARD INTEGRATIONS ORIGINATING AT THE ENDPOINT OF SUBSEQUENT CONNECTED INTEGRATIONS	CALCULATIONS
17-27	16-27 19-27 27-35	35-36 35-37 35-38	7
16-27	17-27 19-27 27-35	35-36 35-37 35-38	7
19-27	16-27 17-27 27-35	35-36 35-37 35-38	7
20-29	21-29 22-29 29-35	35-36 35-37 35-38	7
21-29	20-39 22-29 29-35	35-36 35-37 35-38	7
22-29	20-29 21-29 29-35	35-36 35-37 35-38	7
26-35	30-35 27-35 29-35 28-35 31-35 35-36 35-37 35-38	-	9
30-35	26-35 27-35 29-35 28-35 31-35 35-36 35-37 35-38	-	9
27-35	26-35 30-35 29-35 28-35 31-35 35-36 35-37 35-38	-	9
29-35	26-35 30-35 27-35 28-35 31-35 35-36 35-37 35-38	-	9
28-35	26-35 30-35 27-35 29-35 31-35 35-36 35-37 35-38	-	9
31-35	26-35 30-35 27-35 29-35 28-35 35-36 35-37 35-38	-	9
		TOTAL =	96

TABLE D

INTEGRATION TIME WEIGHT CALCULATIONS
FOR PERIOD 1 FOR SAMPLE
PARTICIPANT "COMPLEX TEST"

FORWARD INTEGRATIONS IN PERIOD 1		TIME OF EXECUTION*		TIME ELAPSED IN MINUTES OF SIMULATION TIME
Origin Decision	Endpoint Decision	Origin Decision	Endpoint Decision	
1	2	.5	2.5	2
2	3	2.5	4.5	2
3	4	4.5	6.5	2
3	7	4.5	12.5	8
4	7	6.5	12.5	6
5	7	8.5	12.5	4
7	9	12.5	16.5	4
7	10	12.5	18.5	6
7	16	12.5	30.5	18
11	16	20.5	30.5	10
9	17	16.5	32.5	16
10	17	18.5	32.5	14
14	26	26.5	50.5	24
				Σ = 116

*All execution times in this sample happen to fall on even minutes and at half minutes; however, the computer registers execution times at any tenth of any minute. (From Unger and Swezey, 1983)

- Execute decision B (the origin decision) in a different category from decision A
- Report that decision B was based in part on decision A

Note that backward integrations, unlike forward integrations, originate at a time later than their endpoints. Both forward and backward integrations, however, are credited to the period during which they originated.

It is easier to calculate backward integrations from the time-event matrix in Figure A than from Table A. On the matrix, a backward integration is a diagonal with a backward arrow pointing to the endpoint. There are no backward integrations in periods 1 and 3 of the sample. Period 2 has two backward integrations, 23 to 15 and 23 to 18.

Unintegrated respondent decisions (Measure 8) is the total number of unintegrated respondent decisions within a period. An unintegrated respondent decision occurs in response to a message, but may not originate a forward integration. An unintegrated respondent decision may, however, be part of a backward integration, or the endpoint of a forward integration, and it may lead to another decision in the same category. Unintegrated respondent decisions are a special case of respondent decisions because general respondent decisions may be any part of an integration. To score an unintegrated respondent decision, a participant must:

- Execute decision A (A may be planned or not planned)
- Report that decision A was based on a previous message

AND EITHER

- At the time decision A is executed, not report a decision plan in a different category

OR

- Report a decision plan in a different category, execute the plan, but not report it based on decision A

In order to calculate number of unintegrated respondent decisions we need more information than is shown on the time-event matrix, so we use Table A. We will first find all the respondent decisions, then test to see if they originate forward integrations which will exclude them from being "unintegrated."

For period 1, the respondent decisions are 1, 2, 8, 9, and 15. Decisions 1 and 2 originate forward integrations so they are not unintegrated. Decision 8 leads only to a decision in its own category so it is unintegrated. Decision 9 originates a forward integration. Decision 15 does not originate a forward integration and is unintegrated. Thus, Decisions 8 and 15 are the only two unintegrated respondent decisions in period 1.

For period 2, the respondent decisions are numbers 23, 24, and 25. None of them originates a forward integration and are all unintegrated according to the use of the word unintegrated in this measure. Decision 23 originates two backward integrations, but still counts as unintegrated.

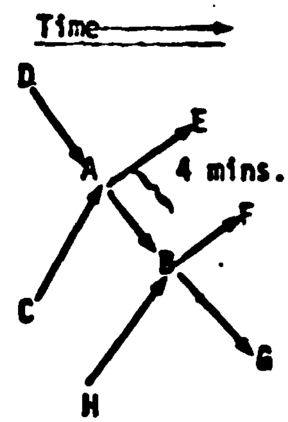
For period 3, the respondent decisions are 32 and 33. Decision 33 originates a forward integration; 32 is an unintegrated respondent decision.

QIS or quality of integrated strategies (Measure 9) is the sum of, for each forward integration scored in a period, the time weight for that integration multiplied by the sum of the number of forward integrations originating and ending at the origin and endpoint of the forward integration plus one for that forward integration.

QIS may be thought of as reflecting the complexity of plans at any point. Where plans are connected in a strategy, QIS is high. The QIS score is low where integrations are not connected. QIS also increases with the time interval from origin to endpoint of integration. Two samples of QIS calculations follow.

The sample below was used in the body of the report. If vector AB is a forward integration, and forward integration vectors CA and DA end at decision A in AB, and AE originates at A in AB, and forward integration vectors BF and BG originate at B in AB, and HB ends at B in AB, and the time elapsed from A to B is four minutes, the QIS score is four (the time weight) multiplied by the sum one for AB plus three for CA, DA, and AE, plus three for BF, BG, and HB, or 4(7) or 28.

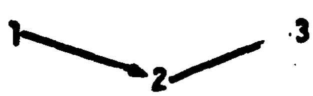
Category
111
121
123
131
211
222
232
311



Period 3 of the sample provides a more complex example of the QIS calculation. To calculate QIS for period 3 in the sample, refer to the time-event matrix and Table E.

Weighted QIS (Measure 10) is the sum of each forward integration scored in a period, plus all forward integrations originating and ending at both ends of the forward integration, plus all forward integrations originating (not ending) in the endpoint of subsequent, directly connected integrations until the end of the simulation, plus all forward integrations ending (not originating) in the origin of previous directly connected integrations until the beginning of the simulation, multiplied by the time weight.

Weighted QIS and QIS are equal when the strategy employed links only three or two decisions together; that is, one forward integration linked to one other forward integration, or just one forward integration not connected to any other integration.



QIS = WQIS

TABLE E

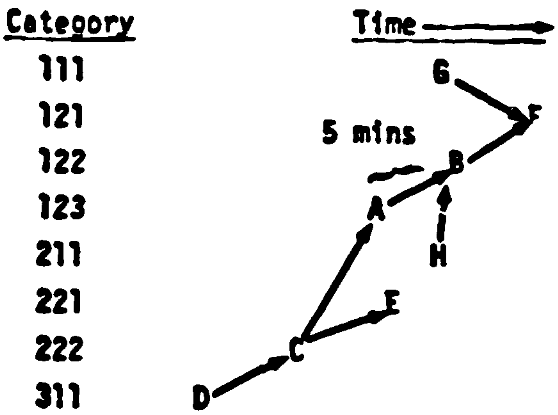
CALCULATION OF QIS FOR PERIOD 3
USING SAMPLE PARTICIPANT "COMPLEX TEST"

FORWARD INTEGRATIONS SCORED IN PERIOD 3			FORWARD INTEGRATIONS CONNECTING TO AND FROM ORIGIN DECISION	FORWARD INTEGRATIONS CONNECTING TO AND FROM ENDPOINT DECISION	TIME WEIGHT	CALCULATION Weight(1 + integrations around origin + integrations around endpoint)
Origin Decision		Endpoint Decision				
33	-	38	-	35-38	10	10(1 + 0 + 1) = 20
35	-	36	26-35 30-35 27-35 29-35 28-35 31-35 35-37 35-38	-	2	2(1 + 8 + 0) = 18
35	-	37	26-35 30-35 27-35 29-35 28-35 31-35 35-36 35-38	-	4	4(1 + 8 + 0) = 36
35	-	38	26-35 30-35 27-35 29-35 28-35 31-35 35-36 35-37	33-38	6	6(1 + 8 + 1) = 60
						134

However, if four decisions or three forward integrations are linked, weighted QIS increases over QIS because weighted QIS considers all forward integrations linked from beginning to end of simulation, and QIS considers only those directly adjoined to any one forward integration:

WQIS >QIS

Two sample calculations follow. The first example was used in the body of the report. Refer to the diagram below.



If vector AB is a forward integration, and forward integration CA connects to A in AB, and DC connects to C in CA, and CE connects to C in CA, and BF and HB connect to B in BA, and GF connects to F in BF, and time elapsed from A to B is five minutes, the weighted QIS score is five multiplied by the sum of one for AB plus one each for CA and DC (not CE which originates not ends in DC and CA), plus one each for HB and BF (not GF which ends not originates in BF), or 5(5) = 25. Weighted QIS is <u>not</u> QIS multiplied by the integration time weight as the name might imply. It is QIS (which already includes time weight) weighted with integrations distally connected to [illegible] target integration.

[The QIS score for the above sample would be five times (1 for AB + 1 for CA + 1 for BF + 1 for HB) = 5(4) = 20. The Multiplexity F for the sample would be one for AB plus one for HB plus one for BF or three. Multiplexity F is essentially the forward half of WQIS minus the time weight.]

WQIS for period 3 of the sample provides a more complex example. Refer to the time-event matrix in Figure A and Table F.

Average response speed (Measure 11) is the average time (in real minutes of simulation time) elapsed between receipt of a message and subsequent execution of a respondent decision. (Recall that a respondent deicsion is one the participant reports was based on a previous message. See Measure 2.) The calculation is based on every respondent decision within a period.

To calculate average response speed for period 1 in the sample, refer to Table A and Table G.

Number of serial connections (Measure 12) is the number of serial connections scored in one period. A serial connection would be identical to an integration (see Measures 4 and 7) except that decisions connected serially fall in the same decision category, whereas integrated decisions fall in different decision categories.

A serial connection may be either forward or backward; this measure includes both types. To score a serial connection, the participant must:

- Execute decision A
- Plan decision B in the same category
- Report that decision B was based on decision A

OR

- Execute decision A

TABLE F

CALCULATION OF WQIS FOR PERIOD 3 OF SAMPLE PARTICIPANT "COMPLEX TEST"

FORWARD INTEGRATIONS SCORED IN PERIOD 3	ALL FORWARD INTEGRATIONS DIRECTLY CONNECTED TO BOTH ENDS OF THE FORWARD INTEGRATION OF INTEREST	CONNECTED FORWARD INTEGRATIONS LEADING TO THE END OF THE SIMULATION	CONNECTED FORWARD INTEGRATIONS LEADING TO THE BEGINNING OF THE SIMULATION	CALCULATION TIME WEIGHT (SUM OF EACH OF THE FOUR COLUMNS)
33-38	36-38	-	31-35 28-35 29-35 27-35 30-35 26-35 * 14-26 ** 22-29 21-29 20-29 19-27 17-27 16-27 9-17 10-17 7-9 7-10 *** 11-16 7-16 **** 5-7 4-7 3-4 3-7 2-3 1-2	10(1+1+0+25) = 270
35-36	35-38 35-37 31-35 28-35 29-35 27-35 30-35 26-35	-	14-26 ** 22-29 21-29 20-29 19-27 17-27 16-27 9-17 10-17 7-9 7-10 *** 11-16 7-16 **** 5-7 4-7 3-4 3-7 2-3 1-2	2(1+8+0+19) = 56
35-37	35-38 35-36 31-35 28-35 29-35 27-35 30-35 26-35	-	14-26 ** 22-29 21-29 20-29 19-27 17-27 16-27 9-17 10-17 7-9 7-10 *** 11-16 7-16 **** 5-7 4-7 3-4 3-7 2-3 1-2	4(1+8+0+19) = 112
36-38	33-38 35-37 35-36 31-35 28-35 29-35 27-35 30-35 26-35	-	14-26 ** 22-29 21-29 20-29 19-27 17-27 16-27 9-17 10-17 7-9 7-10 *** 11-16 7-16 **** 5-7 4-7 3-4 3-7 2-3 1-2	6(1+9+0+19) = 174 TOTAL = 612

*35-36 and 35-37 do not count because they connect origin to origin
**14-30 is a serial connection, not an integration
***9-12 does not count because (a) it is an origin-origin connection and (b) it is serial
****7-8 and 8-11 are serial connections

TABLE 6

AVERAGE RESPONSE SPEED CALCULATION
FOR PERIOD 1 FOR SAMPLE
PARTICIPANT "COMPLEX TEST"
(from Unger and Swezey, 1983)

RESPONDENT DECISION	TIME MESSAGE DELIVERED*	TIME RESPONDENT DECISION EXECUTED	RESPONSE SPEED
1	0	.5	.5
2	0	2.5	2.5
8	12	14.5	2.5
9	12	16.5	4.5
15	24	28.5	4.5
			Σ 14.5
			$\bar{x}$ = 2.9

*Messages in period 1 appeared every three real minutes of simulation time.

- Not plan decision B
- Execute decision B in the same category as decision A
- Report that decision B was based on decision A

A serial connection in a forward direction is credited to the period of the origin decision even if the endpoint occurs in a different period. A serial connection in a backward direction is also credited to the period of the origin decision, but in this type of connection, the origin decision occurs after the endpoint decision because the endpoint is designated only retrospectively.

We can count serial connections in period 1 of the sample by counting the horizontal (not diagonal) lines with forward or backward arrows in the time-event matrix (Figure A). The serial connections are decisions 7 to 8, 8 to 11, 9 to 12, and 14 to 30. There are no serial connections in periods 2 and 3.

Planned integrations (Measure 13) is the number of forward integrations planned but not executed any time before the end of the simulation. If the integration is accomplished at any time, even in a later period than the origin decision, it is considered an executed integration. Planned but not executed integrations are credited to the period in which the origin decision was entered. The planned decision must be in a different decision category from the origin decision category. To score a planned but not executed integration, the participant must:

- Execute decision A
- Plan decision B in another category

AND EITHER

- Not execute decision B

OR

- Execute decision B (or any decision in B category) but not report that decision B was based on decision A

To calculate planned but not executed integrations, refer to Table A. In period 1, when decision 1 was executed, decision 1121 was planned, in a different category from origin decision 1111. Decision 1121 was executed (decision 2) and it was reported based on decision 1. Thus, the integration was executed and does not count in this measure. We check each planned decision in this way to see if it was executed. At decision 10 (212), we see that decisions 1331, 2211, and 2212 were planned. Decision 1331 was executed in period 2 (decision 17), reported based on decision 10 and, thus, the integration was accomplished. Decision 2211 (planned at decision 212 and in a different category) was executed in period 2 (decision 21) but was not reported based on decision 10; therefore, one planned but not executed integration is scored. Planned decision 2212 was never executed, but is not scored as such because it is in the same category as planned but not executed decision 2211 mentioned above.

Period 2 contains no planned but not executed integrations. Decision 1211 was planned three times, executed at decision 27, and reported based on the appropriate decisions, so three integrations scored. Decision 1321 was planned but also executed three times. The 12 plans at decisions 26 through 31 are all in the same 322 category, and when decision 3221 (decision 35) was executed it was reported based on decisions 26, 27, 28, 29, 30, and 31. Thus, six more integrations scored in period 2 (easy to see on the time-event matrix).

Period 3 contains three planned but not executed integrations: 1221, 1111, and 1111.

General unintegrated decisions (Measure 14) is the number of general unintegrated decisions within a period. A general unintegrated decision is a decision which is not part of a forward or backward integration. It may be part of a serial connection, or it may be respondent, or planned but not executed, or planned, executed, but not reported based on the previous decision, or isolated completely. Unintegrated respondent decisions and planned but not executed integrations are subsets (may be overlapping) of general unintegrated decisions.

General unintegrated decisions are easy to spot on the time-event matrix. In period 1, decisions 6 and 13 stand alone; 8 and 12 are part of serial connections not integrations. Every other decision in period 1 is part of an integration. In periods 2 and 3, decisions 24, 25, 32, and 34 stand alone. Every other decision is part of an integration.

APPENDIX B

SAMPLE PARTICIPANT PROFILE

```
ENTER PARTICIPANT CODE:COMPLEX TEST

DATA LIST? (Y/N):Y

NUMBER OF MINUTES IN SIMULATION:74
NUMBER OF MESSAGES=24
NUMBER OF DECISIONS=38
NUMBER OF PERIODS=3
R1/COMPLEX TEST
YOUR DECISION TO REDUCE CREDIT TO YUGOSLAVIA BY 1 MILLION DOLLARS @!-26 250
TIME=32.5
PERIOD=2    MESSAGES=12
DECISION NUMBER=17  TIME=06/18 21:53:38
(#D1321.1)
FUTURE DECISIONS:(#D1211.1)
BASED ON DECISIONS:9110
BASED ON MESSAGES:0

R2/COMPLEX TEST
YOUR DECISION TO SEND MESSAGES CONCERNING THE POTENTIAL IMPOSITION OF ECONOMIL SA
NCTIONS TO THE RUSSIAN  AMBASSADOR
TIME=34.5
PERIOD=2    MESSAGES=12
DECISION NUMBER=18  TIME=06/18 21:55:52
(#D2111.1#D2112.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

R4 COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF HIGH TECHNOLOGY PRODUCTS TO RUSSIA
TIME=36.5
PERIOD=2    MESSAGES=12
DECISION NUMBER=19  TIME=06/18 21:57:45
(#D1121.1)
FUTURE DECISIONS:(#D1211.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

R5/COMPLEX TEST
YOUR DECISION TO SEND MESSAGES CONCERNING THE POTENTIAL INVOLVEMENT OF U.S. FORCE
S IN YUGOSLAVIA TO THE RUSSIAN  AMBASSADOR
TIME=38.5
PERIOD=2    MESSAGES=13
DECISION NUMBER=20  TIME=06/18 21:59:53
(#D2131.1#D2132.1)
FUTURE DECISIONS:(#D1321.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

R7/COMPLEX TEST
YOUR DECISION TO SEND DIPLOMATS TO DISCUSS POTENTIAL IMPOSITION OF ECONOMIC SANCT
IONS WITH THE RUSSIAN  AMBASSADOR @!79>750
TIME=40.5
PERIOD=2    MESSAGES=13
DECISION NUMBER=21  TIME=06/18 22:02:28
(#D2211.1#D2212.1)
FUTURE DECISIONS:(#D1321.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0
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R8/COMPLEX TEST
YOUR DECISION TO SEND DIPLOMATS TO DISCUSS POTENTIAL RESUMPTION OF NORMAL TRADE W
ITH THE RUSSIAN  AMBASSADOR @!=79.75@
TIME=42.5
PERIOD=2    MESSAGES=13
DECISION NUMBER=22  TIME=06/18 22:04:50
(:D2221.1:D2222.1)
FUTURE DECISIONS:(:D1321.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

R9/COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF FOOD TO RUSSIA  HAS BEEN SUCCESSFULLY COMPLETE
D.
TIME=.5
PERIOD=1    MESSAGES=1
DECISION NUMBER=1  TIME=06/18 19:40:38
(:D1111.1)

FUTURE DECISIONS:(:D1121.1)
BASED ON DECISIONS:N
BASED ON MESSAGES:1

R10/COMPLEX TEST
YOUR DECISION TO REDUCE IMPORTS OF MANUFACTURED GOODS FROM RUSSIA
TIME=44.5
PERIOD=2    MESSAGES=13
DECISION NUMBER=23  TIME=06/18 22:07:12
(:D1221.1)
BASED ON DECISIONS:15:18
BASED ON MESSAGES:13

R11/COMPLEX TEST
YOUR DECISION TO ARRANGE A CONFERENCE WITH CABINET MEMBERS TO ASSESS PREVIOUS  PO
LITICAL ACTIONS @!=83.85@
TIME=46.5
PERIOD=2    MESSAGES=14
DECISION NUMBER=24  TIME=06/18 22:10:51
(:D2311.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:14

R13/COMPLEX TEST
YOUR DECISION TO SEND MESSAGES CONCERNING THE POTENTIAL IMPOSITION OF ECONOMIC SA
NCTIONS TO THE RUSSIAN  AMBASSADOR
TIME=46.5
PERIOD=2    MESSAGES=14
DECISION NUMBER=25  TIME=06/18 22:12:53
(:D2111.1:D2112.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:14

R14/COMPLEX TEST
YOUR DECISION TO ALERT U.S. SIXTH FLEET  TO PREPARE TO MOVE
TIME=50.5
PERIOD=2    MESSAGES=14
DECISION NUMBER=26  TIME=06/18 22:14:50
(:D3211.1)
FUTURE DECISIONS:(:D3221.1:D3222.1)
BASED ON DECISIONS:14
BASED ON MESSAGES:0

R15/COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF HIGH TECHNOLOGY PRODUCTS TO RUSSIA  HAS BEEN S
UCCESSFULLY COMPLETED.
TIME=2.5
PERIOD=1    MESSAGES=1
DECISION NUMBER=2  TIME=06/18 19:42:43
(:D1121.1)
FUTURE DECISIONS:(:D3211.1:D3212.1)
BASED ON DECISIONS:1
BASED ON MESSAGES:1

R16/COMPLEX TEST
YOUR DECISION TO REDUCE IMPORTS OF RAW MATERIALS FROM RUSSIA
TIME=52.5
PERIOD=2    MESSAGES=15
DECISION NUMBER=27  TIME=06/18 22:17:16
(:D1211.1)
FUTURE DECISIONS:(:D3221.1:D3222.1)
BASED ON DECISIONS:16:17:19
BASED ON MESSAGES:0

R17/COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF FOOD TO RUSSIA
TIME=54.5
PERIOD=2    MESSAGES=15
DECISION NUMBER=28  TIME=06/18 22:19:44
(:D1111.1)
FUTURE DECISIONS:(:D3221.1:D3222.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0
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R18/COMPLEX TEST
YOUR DECISION TO MOVE U.S. SIXTH FLEET  TASK FORCE A TO THE ADRIATIC SEA  HAS BEE
N SUCCESSFULLY ACCOMPLISHED.@!=2/20@
TIME=4.5
PERIOD=1    MESSAGES=2
DECISION NUMBER=3  TIME=06/18 19:45:03

(;D3211.1;D3212.1)
FUTURE DECISIONS:(;D1211.1)(;D3221.1;D3222.1)
BASED ON DECISIONS:2
BASED ON MESSAGES:0

R19/COMPLEX TEST
YOUR DECISION TO REDUCE CREDIT TO BULGARIA BY 1 MILLION DOLLARS @!-28 24@
TIME=56.5
PERIOD=2    MESSAGES=15
DECISION NUMBER=29  TIME=06/18 22:22:04
(;D1321.1)
FUTURE DECISIONS:(;D3221.1;D3222.1)
BASED ON DECISIONS:20;21;22
BASED ON MESSAGES:0

R20/COMPLEX TEST
YOUR DECISION TO ARRANGE A CONFERENCE WITH CABINET MEMBERS TO PLAN FUTURE  POLITI
CAL ACTIONS @!=84 86@
TIME=58.5
PERIOD=2    MESSAGES=15
DECISION NUMBER=30  TIME=06/18 22:24:40
(;D2321.1)
FUTURE DECISIONS:(;D3221.1;D3222.1)
BASED ON DECISIONS:14
BASED ON MESSAGES:0

R21/COMPLEX TEST
YOUR DECISION TO REDUCE IMPORTS OF RAW MATERIALS FROM RUSSIA  HAS BEEN SUCCESSFUL
LY COMPLETED.
TIME=6.5
PERIOD=1    MESSAGES=3
DECISION NUMBER=4  TIME=06/18 19:48:08
(;D1211.1)
FUTURE DECISIONS:(;D3221.1;D3222.1)
BASED ON DECISIONS:3
BASED ON MESSAGES:0

R22/COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF FOOD TO RUSSIA
TIME=60.5
PERIOD=2    MESSAGES=16
DECISION NUMBER=31  TIME=06/18 22:27:06
(;D1111.1)
FUTURE DECISIONS:(;D3221.1;D3222.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

R23/COMPLEX TEST
YOUR DECISION TO SEND MESSAGES CONCERNING THE POTENTIAL IMPOSITION OF ECONOMIC SA
NCTIONS TO THE RUSSIAN  AMBASSADOR
TIME=62.5
PERIOD=3    MESSAGES=18
DECISION NUMBER=32  TIME=06/19 00:01:50
(;D2111.1;D2112.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:18

R24/COMPLEX TEST
YOUR DECISION TO TRANSMIT FALSE INFORMATION ABOUT PLANNED US MILITARY ACTIONS IN
RUSSIA
TIME=64.5
PERIOD=3    MESSAGES=19
DECISION NUMBER=33  TIME=06/19 00:03:51
(;D4111.1)
FUTURE DECISIONS:(;D2231.1;D2232.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:19

R26/COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF HIGH TECHNOLOGY PRODUCTS TO RUSSIA
TIME=66.5
PERIOD=3    MESSAGES=20
DECISION NUMBER=34  TIME=06/19 00:06:26
(;D1121.1)
FUTURE DECISIONS:(;D1221.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

R27/COMPLEX TEST
YOUR DECISION TO MOVE U.S. AIR FORCE  INTERCEPTOR SQUADRONS (W. GERM) TO AIRFIELD
```

S IN BRITAIN @!=51.46@
TIME=66.5
PERIOD=3 MESSAGES=21
DECISION NUMBER=35 TIME=06/19 00:11:38
(:D3221.1:D3222.1)
FUTURE DECISIONS:(:D1211.1)(:D1331.1)(:D2231.1:D2232.1)
BASED ON DECISIONS:26:27:28:29:30:31
BASED ON MESSAGES:0

F29/COMPLEX TEST
YOUR DECISION TO REDUCE IMPORTS OF RAW MATERIALS FROM RUSSIA
TIME=70.5
PERIOD=3 MESSAGES=22
DECISION NUMBER=36 TIME=06/19 00:15:21
(:D1211.1)
FUTURE DECISIONS:(:D1111.1)
BASED ON DECISIONS:35
BASED ON MESSAGES:0

F31/COMPLEX TEST
YOUR DECISION TO REDUCE IMPORTS OF MANUFACTURED GOODS FROM RUSSIA WAS NOT SUCCES
SFUL.
TIME=8.5
PERIOD=1 MESSAGES=3
DECISION NUMBER=5 TIME=06/18 19:50:48
(:D1221.1)
FUTURE DECISIONS:(:D3221.1:D3222.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

F32/COMPLEX TEST
YOUR DECISION TO REDUCE CREDIT TO YUGOSLAVIA BY 1 MILLION DOLLARS @!-26.25@
TIME=72.5
PERIOD=3 MESSAGES=23
DECISION NUMBER=37 TIME=06/19 00:17:25
(:D1331.1)
FUTURE DECISIONS:(:D1111.1)
BASED ON DECISIONS:35
BASED ON MESSAGES:0

F33/COMPLEX TEST
YOUR DECISION TO SEND DIPLOMATS TO DISCUSS POTENTIAL INVOLVEMENT OF U.S. FORCES I
N YUGOSLAVIA WITH THE RUSSIAN AMBASSADOR @!=79.75@

TIME=74.5
PERIOD=3 MESSAGES=24
DECISION NUMBER=38 TIME=06/19 00:19:39
(:D2231.1:D2232.1)
BASED ON DECISIONS:33:35
BASED ON MESSAGES:0

F38/COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF HIGH TECHNOLOGY PRODUCTS TO RUSSIA HAS BEEN S
UCCESSFULLY COMPLETED.
TIME=10.5
PERIOD=1 MESSAGES=4
DECISION NUMBER=6 TIME=06/18 19:53:25
(:D1121.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

F5?/COMPLEX TEST
YOUR DECISION TO MOVE U.S. AIR FORCE INTERCEPTOR SQUADRONS (W. GERM) TO AIRFIELD
S IN BRITAIN HAS BEEN SUCCESSFULLY ACCOMPLISHED.@!
=51.46@
TIME=12.5
PERIOD=1 MESSAGES=5
DECISION NUMBER=7 TIME=06/18 19:55:17
(:D3221.1:D3222.1)
FUTURE DECISIONS:(:D3211.1:D3212.1)(:D3221.1:D3222.1)(:D1311.1)(:D2121.1:D2122.1)

BASED ON DECISIONS:3:4:5
BASED ON MESSAGES:0

F52/COMPLEX TEST
YOUR DECISION TO MOVE U.S. AIR FORCE INTERCEPTOR SQUADRONS (W. GERM) TO AIRFIELD
S IN BRITAIN HAS BEEN SUCCESSFULLY ACCOMPLISHED.@!
=51.46@
TIME=14.5
PERIOD=1 MESSAGES=5

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DECISION NUMBER=8  TIME=06/18 19:59:59
(#D3221.1#D3222.1)
FUTURE DECISIONS:(#D3221.1#D3222.1)
BASED ON DECISIONS:7
BASED ON MESSAGES:5

R60/COMPLEX TEST
YOUR DECISION TO REDUCE CREDIT TO RUSSIA BY 1 MILLION DOLLARS  WAS NOT SUCCESSFUL
.
TIME=16.5
PERIOD=1   MESSAGES=6
DECISION NUMBER=9  TIME=06/18 20:04:05
(#D1311.1)
FUTURE DECISIONS:(#D1311.1)(#D1331.1)
BASED ON DECISIONS:7
BASED ON MESSAGES:5

R68/COMPLEX TEST
YOUR DECISION TO SEND MESSAGES CONCERNING THE POTENTIAL RESUMPTION OF NORMAL TRAD
E  TO THE RUSSIAN  AMBASSADOR  WAS NOT SUCCESSFUL.
TIME=18.5
PERIOD=1   MESSAGES=7
DECISION NUMBER=10  TIME=06/18 20:06:55
(#D2121.1#D2122.1)
FUTURE DECISIONS:(#D1331.1)(#D2211.1#D2212.1)
BASED ON DECISIONS:7
BASED ON MESSAGES:0

R70/COMPLEX TEST
YOUR DECISION TO MOVE U.S. AIR FORCE  INTERCEPTOR SQUADRONS (W. GERM) TO AIRFIELD
S IN BRITAIN  HAS BEEN SUCCESSFULLY ACCOMPLISHED.@!
 =51 46@
TIME=20.5
PERIOD=1   MESSAGES=7
DECISION NUMBER=11  TIME=06/18 20:09:53
(#D3221.1#D3222.1)
FUTURE DECISIONS:(#D3211.1#D3212.1)
BASED ON DECISIONS:8
BASED ON MESSAGES:0

R75/COMPLEX TEST
YOUR DECISION TO REDUCE CREDIT TO RUSSIA BY 1 MILLION DOLLARS  WAS NOT SUCCESSFUL
.
TIME=22.5
PERIOD=1   MESSAGES=8
DECISION NUMBER=12  TIME=06/18 20:12:29
(#D1311.1)
BASED ON DECISIONS:9
BASED ON MESSAGES:0

P78/COMPLEX TEST
YOUR DECISION TO REDUCE CREDIT TO BULGARIA BY 1 MILLION DOLLARS  HAS BEEN SUCCESS
FULLY COMPLETED.@!-28 240
TIME=24.5
PERIOD=1   MESSAGES=9
DECISION NUMBER=13  TIME=06/18 20:14:25
(#D1321.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

P64/COMPLEX TEST
YOUR DECISION TO ARRANGE A CONFERENCE WITH CABINET MEMBERS TO PLAN FUTURE  POLITI
CAL ACTIONS  WAS NOT SUCCESSFUL.
TIME=26.5
PERIOD=1   MESSAGES=9
DECISION NUMBER=14  TIME=06/18 20:16:51
(#D2321.1)
FUTURE DECISIONS:(#D2321.1)(#D3111.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:0

R66/COMPLEX TEST
YOUR DECISION TO REDUCE EXPORTS OF FOOD TO RUSSIA  HAS BEEN SUCCESSFULLY COMPLETE
D.
TIME=26.5
PERIOD=1   MESSAGES=10
DECISION NUMBER=15  TIME=06/18 20:19:50
(#D1111.1)
BASED ON DECISIONS:0
BASED ON MESSAGES:9
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R86/COMPLEX TEST
YOUR DECISION TO MOVE U.S. SIXTH FLEET  TASK FORCE A TO THE ADRIATIC SEA  HAS BEE
N SUCCESSFULLY ACCOMPLISHED.@!=2.20@
TIME=30.5
PERIOD=2   MESSAGES=11
DECISION NUMBER=16  TIME=06/18 21:50:59
(;D3211.1;D3212.1)
FUTURE DECISIONS:(;D1211.1)
BASED ON DECISIONS:7;11
BASED ON MESSAGES:0


NUMBER OF CATEGORIES= 19
111
112
121
122
131
132
133
211
212
213
221
223
234
[illegible]
311
324
322
411

PERIOD 1
1-MEASURE=15 (# OF DECISIONS)
2-MEASURE=5   33% (# OF RESPONDENT DEC.)
3-MEASURE=10 (# OF DEC. CATEGORIES)
4-MEASURE=13  86% (# OF FWD INTEGRATIONS)
5-MEASURE=133  886% (MULTIPLEXITY F)
6-MEASURE=116 MINUTES (WEIGHT)
7-MEASURE=0  0% (# OF BAD INTEG)
8-MEASURE=2  13% (# OF UNINTEG.RES.DEC.)
9-MEASURE=562 (QIS)
10-MEASURE=2052 (WEIGHTED QIS)
11-MEASURE=2.9 (AVE.RESPONSE SPEED)
12-MEASURE=4 (SERIAL CONNECTIONS)
13-MEASURE=1 (PLANNED INTEGRATIONS)
14-MEASURE=4 (GENERAL UNINTEGRATED DEC.)
PERIOD 2
1-MEASURE=16 (# OF DECISIONS)
2-MEASURE=3   18% (# OF RESPONDENT DEC.)
3-MEASURE=14 (# OF DEC. CATEGORIES)
4-MEASURE=12  75% (# OF FWD INTEGRATIONS)
5-MEASURE=96  600% (MULTIPLEXITY F)
6-MEASURE=184 MINUTES (WEIGHT)
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7-MEASURE=2 12% (# OF BKD INTEG)
8-MEASURE=3 18% (# OF UNINTEG.RES.DEC.)
9-MEASURE=1312 (QIS)
10-MEASURE=3874 (WEIGHTED QIS)
11-MEASURE=3.83333333 (AVE.RESPONSE SPEED)
12-MEASURE=0 (SERIAL CONNECTIONS)
13-MEASURE=0 (PLANNED INTEGRATIONS)
14-MEASURE=2 (GENERAL UNINTEGRATED DEC.)

PERIOD 3
1-MEASURE=7 (# OF DECISIONS)
2-MEASURE=2 28% (# OF RESPONDENT DEC.)
3-MEASURE=7 (# OF DEC. CATEGORIES)
4-MEASURE=4 57% (# OF FWD INTEGRATIONS)
5-MEASURE=6 85% (MULTIPLEXITY F)
6-MEASURE=22 MINUTES (WEIGHT)
7-MEASURE=0 0% (# OF BKD INTEG)
8-MEASURE=1 14% (# OF UNINTEG.RES.DEC.)
9-MEASURE=134 (QIS)
10-MEASURE=612 (WEIGHTED QIS)
11-MEASURE=.5 (AVE.RESPONSE SPEED)
12-MEASURE=0 (SERIAL CONNECTIONS)
13-MEASURE=3 (PLANNED INTEGRATIONS)
14-MEASURE=2 (GENERAL UNINTEGRATED DEC.)